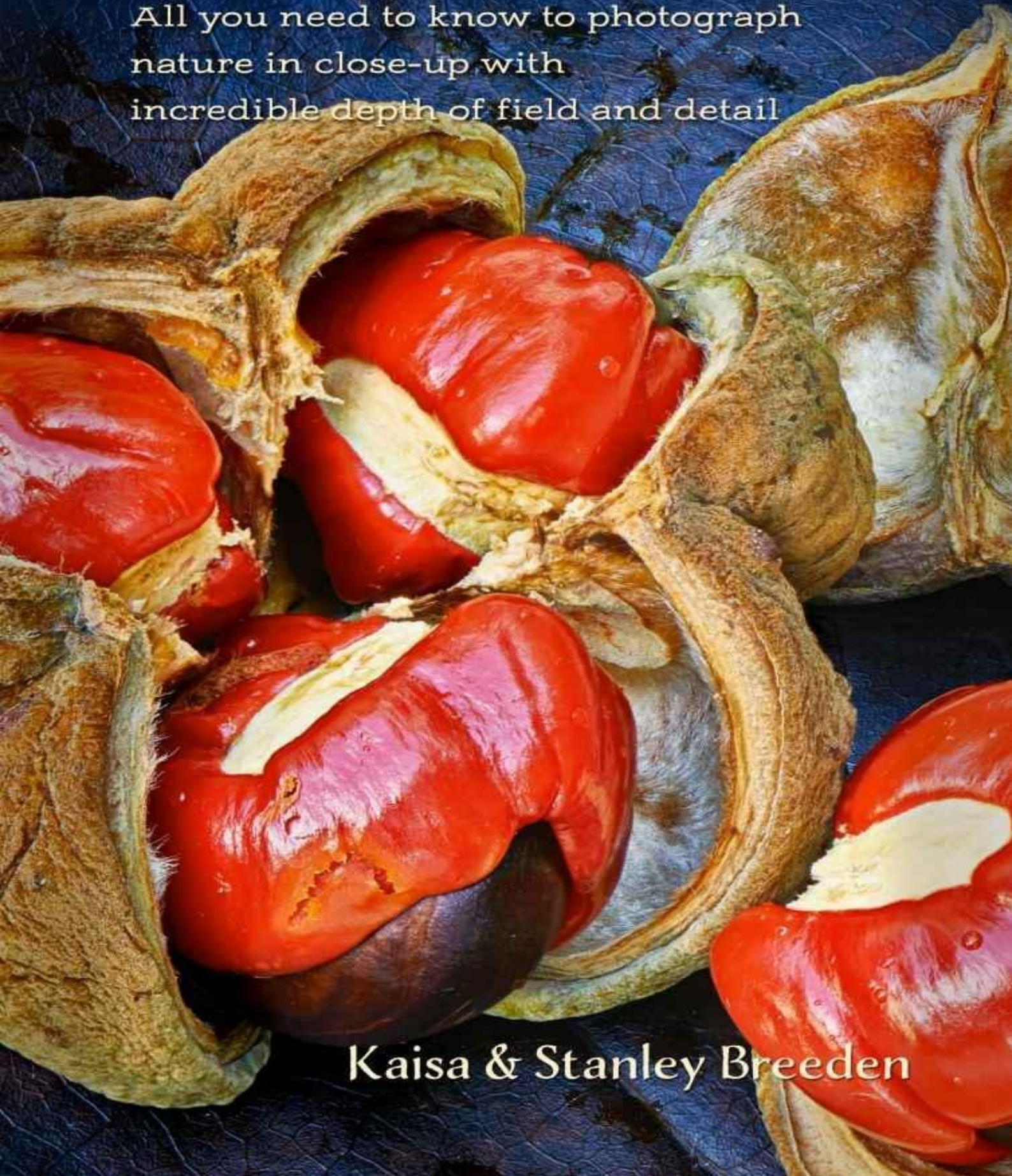


# FOCUS STACKING IN THE WILD

All you need to know to photograph  
nature in close-up with  
incredible depth of field and detail



Kaisa & Stanley Breeden



# **FOCUS STACKING IN THE WILD**

ALL YOU NEED TO KNOW TO PHOTOGRAPH NATURE IN CLOSE-UP WITH INCREDIBLE DEPTH OF FIELD  
AND DETAIL

KAISA BREEDEN  
STANLEY BREEDEN



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# **FOCUS STACKING IN THE WILD**

ALL YOU NEED TO KNOW TO PHOTOGRAPH NATURE IN CLOSE-UP WITH INCREDIBLE DEPTH AND  
DETAIL

**Kaisa & Stanley Breeden**

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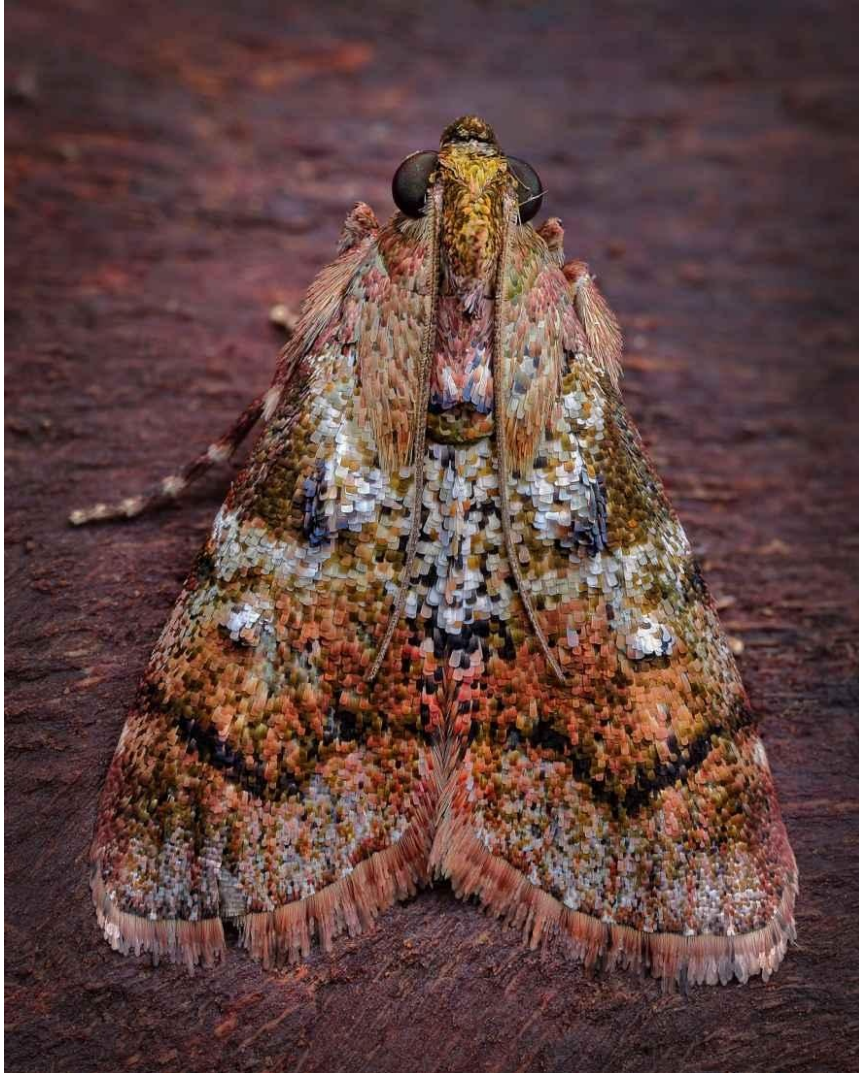
## FOREWORD

### What this book will teach you

This book outlines the *exact techniques we use* to produce the close-up photographs you see in our books, such as [\*Wildflower Country\*](#), [\*Rainforest Country\*](#) and [\*Small Wonders\*](#).

It assumes some familiarity of the reader with Photoshop, not to an advanced degree.

It is not an exhaustive survey of every focus stacking technique, piece of equipment and software, rather **our exact, personal methods** to achieve the ultimate quality with the flexibility needed when working with plants and animals in the wild and in natural light.



*“Proud Moth”. Dignified yet unidentified, this little moth is just 14mm long. A 20-exposure focus stack was needed to capture all the depth and detail.*





## INTRODUCTION



*Striped Marsh Frog. 25 exposures.*

### **A Privileged and Lucky Bunch**

Most readers, we suspect, are already close-up nature photographers. So we won't have to tell you what a privileged bunch we are. Privileged because we enter a secret world full of wonder and steeped in beauty. It is a world not yet wholly explored. All of us can discover new and exciting things that seize our imagination.

We're also lucky because we are taking our pictures in the age of digital photography—we can capture all this wonder and beauty as never before.

If you are new to this field—welcome on this most exciting journey.

### **March towards Digital Photography**

Just imagine you were photographing 150 years ago. Cameras were large and clunky. Pictures were taken on glass plates in cumbersome holders. There was no colour, no close-ups, no telephoto, no depth of field and exposures took forever. If you were game to enough to blunder into the bush with all this stuff your rewards would have been minimal. Animals would flee at your laboured approach and even the plants seem to shrink away.

The turning point came in the 1930's with the invention of the 35mm SLR and colour film. Cameras were now small. You could change lenses—macro for the flowers at your feet and telephoto for the kangaroo on the horizon. Even so it took a while for this equipment to become generally available. But by about 1960 you could go bush with your camera without frightening the animals.

Nothing much changed for the next 40 years. A beetle I (Stan) photographed in 1959 on Kodachrome (then 12.5 ISO) can hold its own with one I took in 2000 on Kodachrome 64.

And all that time one frustrating and limiting factor remained—restricted depth of field.

### **A new vision**

Digital photography and focus stacking has liberated us. They amount to nothing less than a new vision. This term is often used frivolously, but we mean it in its deepest and truest sense.



*Everlasting Daisies. 10 exposures.*







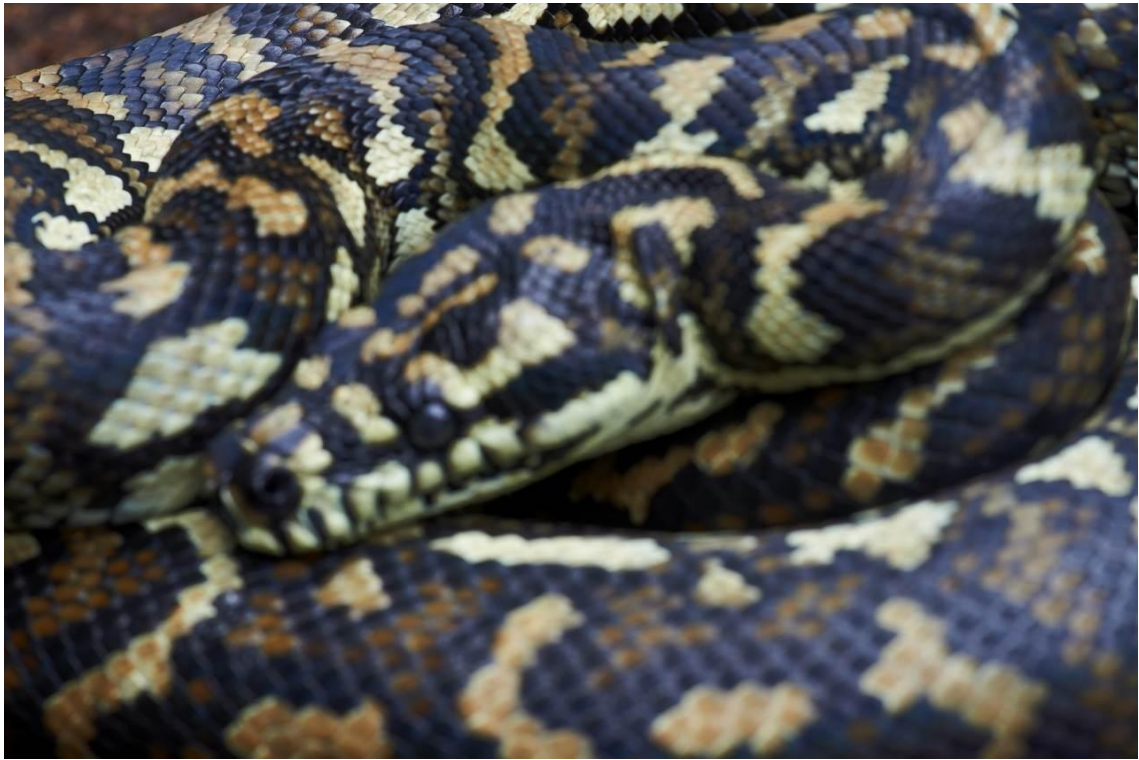
## WHAT IS FOCUS STACKING?

In a close-up photograph, only a thin slice of your subject is in focus. Everything in front of and behind this slice is fuzzy. The narrow slice in focus is called the *depth of field*.

In a close-up of a Carpet Python this means that the front is in focus, or the middle, or the back, but not all of them in the same picture. In digital photography, instead of taking a single exposure with its narrow plane in sharp focus, you can take a succession, each with its own limited depth of field. Using special software, these can then be blended together into a single picture where everything is sharp, front to back. This is [focus stacking](#).



*Foreground in focus: Carpet Python. Exposure 1 of 18. Nikon D800e*



*Background in focus: Exposure 18 of 18.*



*Complete 18-exposure focus stack*







## WHY FOCUS STACK?

We see [focus stacking](#) as a photography much truer to human vision than film ever was. Our aim is for photographs so clear you feel you could almost reach into them and stroke a feather or touch a leaf.

Combined with natural light, focus stacking affords views of nature that your eye can wander into and explore, just as if you were there and stopped to study something closely. It captures the depth your own eyes would have adjusted for.

You are also recording a duration of time, not a single instant. Sometimes we like to leave clues to this: a frog's throat pulsing, a tendril waving. It is almost cinematic.

We can capture subjects with detail that would have been pointless to attempt in a single shot: the long throat of a tubular flower or the length of a skink's scaly back.



*Mountain Bell. Single exposure.*



*Mountain Bell. A 12-exposure focus stack.*







## CLOSE-UP? MACRO? MICRO?

WHICH IS WHICH?

There are a number of definitions of close-up photography. For the purposes of this book we use the ones below.

### Close-up

This definition is somewhat loose and arbitrary. For us, close-ups begin when a subject, not that small, fills the frame—possum's face perhaps or the flowering cone of a banksia. You are not yet 1:1, you are fairly wide.



*Barringtonia Flower. A 15-exposure HDR focus stack. This is a close-up, but not macro.*

FROM THERE ON the closer you go, the bigger the close-up. When the flowers appear  $\frac{1}{2}$  of their natural size on the camera's sensor the ratio between subject and image is said to be 1:2 (see Backgrounds and Bokeh). This is still in the realm of close-up.





*Pilbara Gecko. A 9-exposure focus stack. A close-up.*

## **Macro Photography**

This has a more precise meaning. In macro photography you go so close to your subject that its image on the sensor is actual size, i.e. An 8mm spider would measure 8mm on the sensor. This ratio is 1:1.



*"Brass Button Moth". A 9-exposure focus stack. Macro.*





*Grevillea excelsoir*. A 16-exposure focus stack.

## Micro Photography

Most macro lenses do not focus beyond 1:1. But by using extension rings, focusing bellows or supplementary lenses you can force them to. When you do it becomes microphotography. The ratio then becomes 2:1 (see Backgrounds and Bokeh), 3:1 and so on. At 2:1 for example your 8mm spider will be 16mm on your camera sensor.



*Cupaniopsis* flower, 25mm across. A 34-exposure focus stack, an example of micro photography.



*Sleeping Cuckoo Wasp. A 14-exposure focus stack, microphotography.*

## **Photomicrography**

Microphotography (outlined above) should not be confused with photomicrography, which is the taking of photographs through the microscope.

It's beyond the scope of this book, but seeing as you are interested in focus stacking, you may be interested in [photomicrography](#) as well. The more you know, the more you know.

IN THIS BOOK we stay in the close-up to macro range with an occasional foray into the micro world.







## HOW MANY EXPOSURES DO I NEED?

### AND HOW DO I KNOW?

The closer you go, the more exposures are needed. Just how many will depend on how much depth of field you want, the lens you use (the longer the lens the more exposures), your aperture (the more open, the more exposures), and the distance from your subject (the closer you are the more exposures).

For example, if you photographed a large frog with, say, a 50mm lens stopped down to f16, you may only need 3 or 4 exposures. If you photograph the same frog in big close-up with 180mm lens opened up to f8, you may need as many as 30 exposures.

Ideally, you want a tad of overlap between exposures. That way, you won't have any out-of-focus slivers between in-focus slices.

Always start at the part nearest to you and work towards the furthest away that you want to be in focus. Watch through your viewfinder to judge the increments.







## BACKGROUNDS & BOKEH



*Kangaroo Paw. A 9-exposure focus stack.*

### Background considerations when shooting

It's funny how few photographers really pay attention to their backgrounds. They're so focused on the subject, they don't notice the background tree erupting out of their bird's head or those bright contrasty blotches ruining a cluster of flowers. The more you consider the impact of your background on the subject, the better your photographs will be. Try to avoid distractions, lines, contrasty areas, busyness or other subjects in your backgrounds. Aim for soft bokeh (see below) and smooth tones that frame your prize.

### A word about Bokeh

What the dickens is this, you ask? [Bokeh](#) (pronounced BOH-kay) is a Japanese word meaning a blurry quality (it can also refer to a state of mind). It has been adopted to describe out-of-focus areas in photographs. You control bokeh with lens choice and aperture.

Bokeh separates subject and background in such a way that the animal or plant you photograph pops out at you. Almost 3D.

Pleasing bokeh is of an even tone and contrasts agreeably with its sharply in-focus subject. There should be no bright spots or patterns. Colour however, while remaining harmonious, should not be a single even hue, but subtly varied. We like the bokeh of the picture of the Red and Green Kangaroo Paw at the beginning of this chapter.

Disturbing bokeh has strong spots and patterns that distract and takes your attention away from your primary subject. Also there would be little contrast and tone difference

between background and subject. In such a picture your flower or frog would be in danger of being swallowed up by the background.



*Cymbidium orchid, a 26-exposure focus stack at f8. We chose f8 to give a bokeh that beautifully complements the flowers.*

## **Varying your Aperture to get good Bokeh**

In focus stacking the preferred aperture is f16. It gives the best depth of field, as already mentioned, and a head start in focus stacking.

F16, however, especially in the shorter focal length lenses, does not always give you the best bokeh. When you open up to f8 or even f5.6 your bokeh improves enormously. But then your focus stacking becomes more exacting: because of the shallow depth of field your focus changes for each successive exposure is very slight. If you're careful you can manage it. The photograph of the Cymbidium orchid above is a 26-exposure stack taken at f8.

HERE ARE some examples of effect of lens and aperture on your background bokeh:





*Above: 180mm lens: f16, f8 and f5.6*



*Above: 100mm lens: f16, f8 and f5.6*



*Above: 50mm lens: f16, f8 and f5.6*







# WIND AND LIGHT

## BATTLING THE ELEMENTS

### Best times of day to shoot

Wind can be troublesome. It certainly bothered us at times in Western Australia whilst we photographed [Wildflower Country!](#)



*Wind-tossed featherflowers in Western Australia.*

Stan finds early morning or late afternoon good times to photograph: the wind can be less bothersome then. You also have the advantage of beautiful soft light. We never photograph in the middle of the day, unless it is overcast.

We have toyed with the idea of wind breaks but haven't needed to resort to them yet.

If you want to plan ahead for light and shadow at a particular location, you might consider the esoterics of an app like [The Photographer's Ephemeris](#). Kaisa hasn't got her head around it yet.

### What about shifting light?

We take test shots to ensure our camera's histogram encompasses the tonal range of the subject, paying special attention to the highlights. So we tend to take shifting light in our stride, and not worry too much about it. To learn about exposing to make the most of your camera's sensor, you need to read about [Expose To the Right \(ETTR\)](#). Some people don't believe in it or don't quite get it, but we are all about striving for the best quality at every stage—so we pay attention to it.

If the contrast is too extreme (this becomes more of a rarity with increasing quality and dynamic range of camera sensors), it is time to consider [HDR](#) (High Dynamic Range) focus stacking, which would be the subject of another book.



*Sun-dappled rainforest. A 16-exposure HDR focus stack. For subjects with extreme contrast, we sometimes also use HDR as well as focus stacking. This will be the subject of another book.*

WE TAKE our pictures with natural light. After lengthy experimentation we found it gives the most nuanced, life-like and exciting results. It is never the same. A shift in the clouds, a beam of light through the forest foliage, change in the time of day all bring unexpected, subtle and enlivening changes.

Flash or studio lighting cannot replicate natural light adequately. We like to photograph in the early morning and in the shade. There are exceptions. You may want the full sun to catch sparkle in the dew or the sugary texture of a flower petal.

## **Breezes**

Slow exposures, out in the bush, put you at the mercy of the breeze. The slightest breath of air can move your subject out of focus, and you may not even notice it till back at the computer.

The early morning not only has the gentlest light, it is also the time of least air movement. The best period for close-up photography is from sunrise until two or three hours thereafter.

If you spend enough time poised to fire your cable release between puffs of wind, you become a connoisseur of breezes. You may feel the breeze on your face but the air is still around your subject less than a metre away. The flower you are photographing may be tossed by the wind, but another a few metres away is unmoved. A breeze may caress your ankles while all is still around your face. The air streams and swirls constantly.







## WHEN YOUR SUBJECT FLIES/RUNS AWAY

Yes, beetles fly away half way through a stack. Butterflies flit. Lizards scramble off, frogs and grasshoppers spring. Dragonflies are hardly ever still.

You just have to take your chances, be respectful to the animals and not stress them out, and adopt a philosophical attitude: some things aren't meant to be.



*Blue Damselfly. A 14-exposure focus stack.*







# OUR HARDWARE AND OTHER EQUIPMENT

## CAMERAS TO TRIPODS

### Cameras

You can do focus stacking with most cameras. Kaisa does it successfully with her iPhone. But we feel the SLR with its interchangeable lenses give the best results and are the most easily operated for focus stacking.

We mostly use the Canon 5D MkIII and sometimes a Nikon D800e.

#### SLR vs. Mirrorless

Critical focusing is essential. Stan still does this on a ground glass on his SLR for now, but mirrorless cameras with excellent viewfinders and 100% zoom are a tempting development.

### Lenses

#### Macro Lenses

A macro lens is defined as one that focuses to a 1:1 ratio, that is the subject is captured at actual size on the sensor.

Any macro lens will take pictures suitable for focus stacking. However, different focal lengths will give different results. Your choice will depend on your preferred style of photography—your vision. And your budget.

#### 50mm macro lenses

With shorter focal length lenses you need to be very close to your subject. At 1:1 your lens will be 15cm from your subject. This is a very close working distance—so close that you may be in your own shadow. When you are this close to a lizard or frog, moth or dragonfly, these remain nervous and fidgety. And you may not want to get that close to a venomous snake. Your background, being so wide, can take in unwanted distractions in the form of bright spots and pale lines of grass stems, branches and distant tree trunks.

#### 100mm macro lenses

These are of medium focal length—and probably the most commonly used. Your working distance is now 30cms at 1:1, and your background is less likely to pick up unwanted distractions.

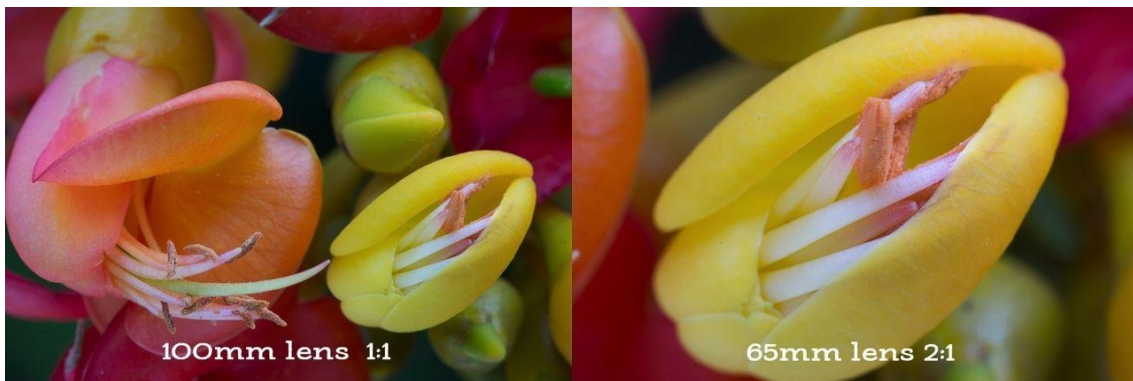
#### 150-200mm macro lenses

Your working distance of 40-50cm at 1:1 is much more comfortable both for you and your subject. The out of focus background is also fuzzier with fewer distractions. That is, your pictures will have beautiful bokeh.

SOME EXAMPLES of ratios with different lenses:



*Above: 180mm lens: 1:2 and 1:1*



*Above: 100mm lens at 1:1, and 65mm lens at 2:1*

## **What we use**

Mostly we use a Canon 5D MkIII with three macro lenses:

- MP-E 65mm f2.8

A focusing range from 1:1 to 5:1, it starts where other macros stop.

- 100mm f2.8
- 180mm f3.5

We take more than 90% of our pictures with the 180mm lens.

We have also used a Nikon D800e with a 105mm f2.8 micro Nikor. We found that the Nikon produced sharper, cleaner images. We have not tried the 200mm micro Nikor.

## **Keeping Steady**

You're only as sharp as you are still

### **Plates & Ballheads**

We use the [BH-55 Ballhead](#) from [Really Right Stuff](#).

We attach our camera with an L bracket also made by Really Right Stuff.

### **Tripods**

If, like us, you use natural light your exposures will be slow—anything from 1/8 of a second to 8 seconds. This you cannot hand-hold. You need a steady tripod with a robust head. A centre column should be avoided, as it is not perfectly steady.

A tripod is needed for another reason. In a series of pictures you take for focus

stacking, each must align perfectly with all the others. Yes, you can get your stacking software to align them for you, but if you are after the best quality possible (as we are), any shift between exposures will make a good stack impossible.

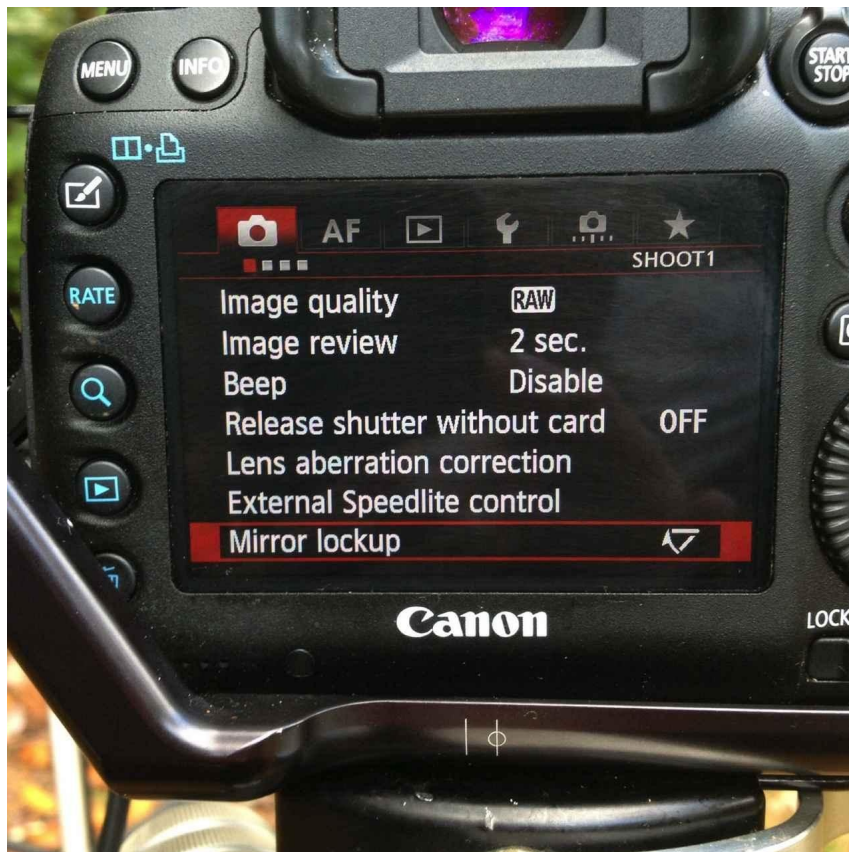


*Use a sturdy tripod. This one is made by Miller.*

### **MIRROR LOCKUP, EFSC and Live View: reducing mirror and shutter shake**

Mirror lockup mode is needed to reduce shake during long exposures and, teamed with a cable release, is the method we use for our work. On Canon cameras, it is a Custom Function (C.Fn), and in Nikons it is in the Drive Modes. Keep in mind you cannot look through the viewfinder when the mirror is locked.





*Mirror Lockup on a Canon 5D MkIII*

Most cameras now have Live View and EFSC (Electronic First Shutter Curtain). Live view can be handy for zooming in to check your focus. At this stage we haven't experimented with it. For more information on using these methods of reducing camera shake, see these links:

<http://www.robertotoole.com/2014/01/28/electronic-first-shutter-curtain/>

[http://www.krebsmicro.com/Canon\\_EFSC/](http://www.krebsmicro.com/Canon_EFSC/)

## **CABLE RELEASE**

You may have spent a small fortune on cameras, lenses and tripod, but unless you have one of the cheapest pieces of kit you'll ever buy, you'll have spent in vain. You can do nothing without a cable release. No matter how careful you are, and how steady your hand you cannot trigger the camera by hand. Vibrations will show even with the gentlest hand. There are electronic triggering devices equally as good as the humble cable release.

## **Other equipment**

### **Reflector**

When you are photographing in a forest clearing, the strongest light may come down from above, perhaps reflected off white clouds or just the sky. A reflector placed below the subject will soften the shadows. There are various reflectors you can buy. We prefer glamorous pieces of white Styrofoam; they can easily be cut to size, are lightweight and cost little or nothing.

## **CLAMPS**

Clamps are useful. They can hold your reflector in place, or steady a long-stemmed

flower with a penchant for dancing in the wind. We use [Wimberley Plamps](#) (yes, plamps with a “p”).



*Reflector held with clamp.*







# GOING BUSH

## WHAT WE BRING

Our kit when going bush needs to have just what we need to get the work done but no more.

We have learned the hard way what it's like to get to a remote location only to realise we've forgotten a vital cable or card reader. Learn from our mistakes.

### ***Our Packing list***

- *Camera (obvious, but you never know when you're in a hurry)*
- *Cable for connecting camera to laptop (if bringing)*
- *3 macro lenses—65mm, 100mm, 180mm*
- *cable release*
- *tripod and head*
- *Spare camera battery (charged)*
- *Battery charger and cables*
- *Spare CF card*
- *Card reader & cable for same*
- *Reflector (styrofoam)*
- *Assortment of clamps*
- *Brush (to remove sand/dirt from subjects)*
- *Laptop & power cables*





## **THE PROCESS IN A NUTSHELL**

1. *Shoot your focus stack*
2. *Transfer your RAW files to your computer*
3. *Check your RAW files for movement*
4. *Develop your RAWs and export as Tiffs*
5. *Import your Tiffs into focus stacking software*
6. *Create your stack*
7. *Edit/retouch your stack in the stacking software*
8. *Export your final stack as a Masterfile*
9. *Open Masterfile in Photoshop for background repair*







# OUR TECHNIQUE: SHOOTING YOUR STACK

## MANUAL FOCUS STACKING

Early one morning, you select a flowering shrub as your subject. The flowers are often visited by insects such as bees, wasps, beetles, moths, butterflies, ants... Because it is still cool they are less active. They more than likely will stay still long enough for you to get your pictures.

### Setting up

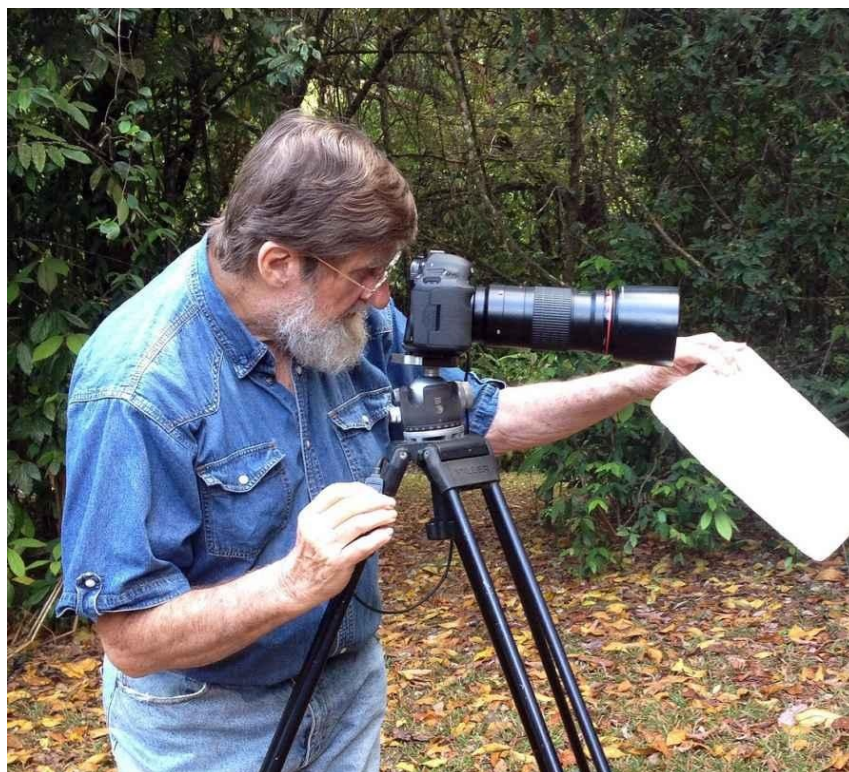
For your first series you may concentrate on a cluster of flowers rather than a single. Walk around the shrub, and search for the grouping that gives you the best composition—and background!

PUT YOUR TRIPOD IN PLACE, mount your camera on top and connect your cable release.

Check that everything is as you want it:

- Mirror lockup is on (see 'Hardware' chapter)
- Auto-focus is off. OFF! We stack manually.
- Select aperture preferred setting (Av). For our method of focus stacking, you need the same aperture for each exposure.
- Set aperture at f16. You want to stop down as far as possible to give your depth of focus a head start—most lenses when stopped down further than f16, i.e. f22 or f32 lose significant definition.

SHOULD YOU NEED A REFLECTOR, put it in place using some ingenious clamp, or hand-hold.



*This is the ingenious Bear holding a styrofoam reflector.*

### Test shot

Once you have composed your picture, find the part nearest to you and focus (manually) on that.

W<sub>HEN ALL IS</sub> ready and steady, take your first test exposure. One squeeze of the cable release to lift the mirror, wait briefly for possible vibration to settle down, and then another squeeze will take the picture.

W<sub>HEN YOUR TRIAL</sub> shot is taken, check the histogram. For best results this should be as far to the right as possible without clipping the highlights.



*Squeezing the cable release.*

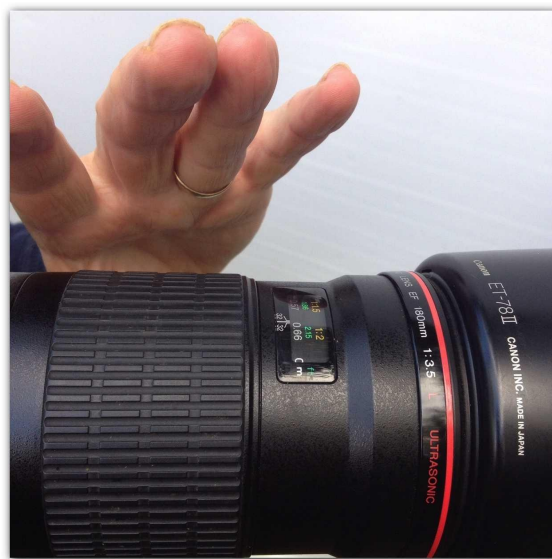
## **Shooting your stack**

When capturing a stack, I (Stan) change focus with the lens ring. I do not physically move the camera, as you would if using macro sliders. The increments are very small (perhaps a millimetre or less). I judge this by eye through the viewfinder. We have tried other methods, but this is the only one so far to give us the flexibility and speed needed to make on-the-fly changes.

S<sub>TARTING</sub> at the part of your subject that is closest and working towards the furthest point, change focus manually in tiny increments, and take another, another, and another until the furthest point you want to be in sharp focus has been photographed. You keep shooting slices of focus until you have covered the depth you desire.



*Manually changing focus*



*Hands off the lens when you're taking the shot!*

BEFORE STARTING ANOTHER STACK, it is helpful to take a shot of your hand (or something obvious) to mark the separation. Otherwise, it can be confusing when back at the computer, looking at hundreds of pictures all of the same composition and trying to find the new sequence.





*Take a shot of your hand in between stacks to clearly mark your sequences.*

You may now want to move closer and take more detailed close-ups even going to true macro 1:1.

**THE CLOSER YOU** are to your subject, the more shots you will need in a series.

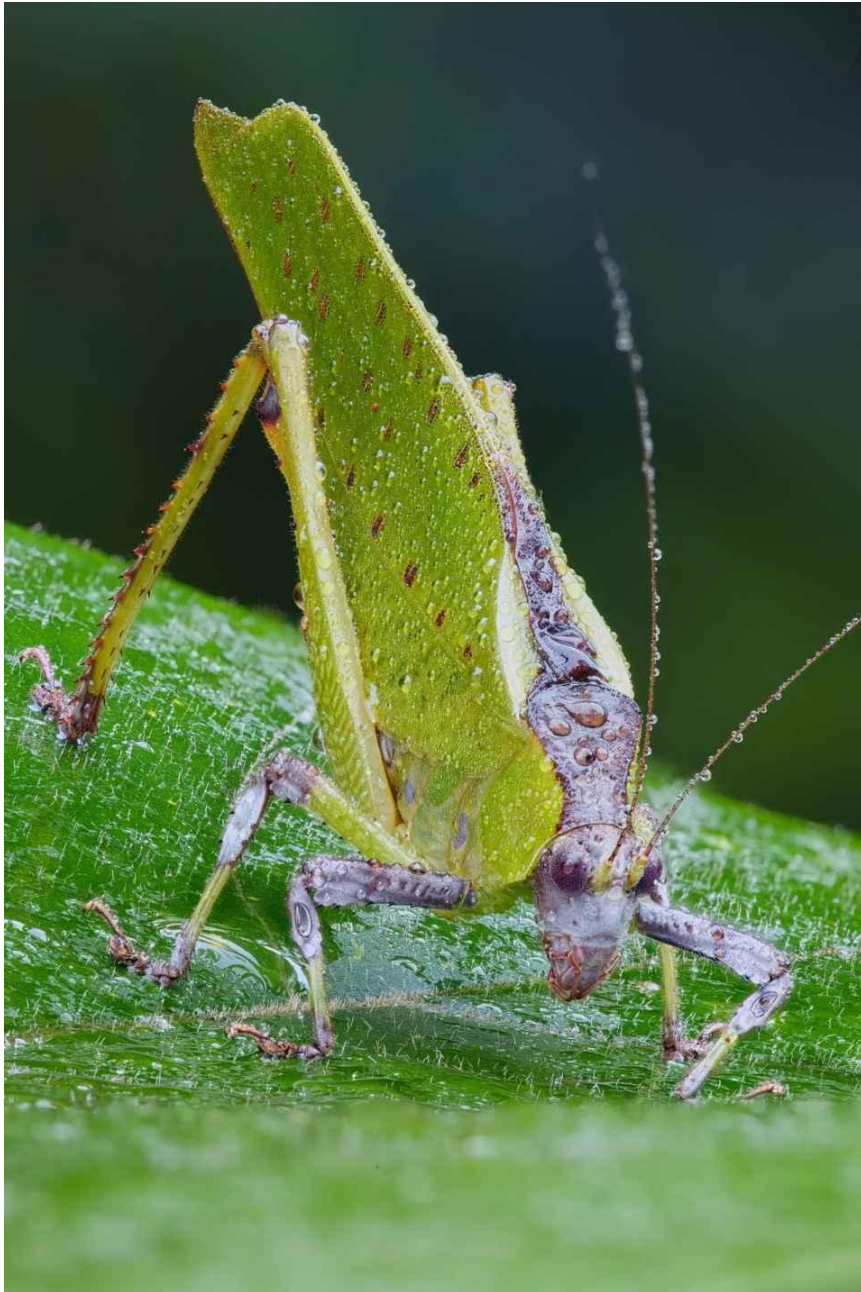
**THE WIDER SERIES** of your cluster of flowers may require as few as 4 or 5 exposures, while a big close-up may need 30 or more.



*Conebush flowers. A 6-exposure focus stack.*

The photograph above of Conebush flowers is a 6 exposure stack. The katydid,

below, being head on to the camera, required 40. Focus stacking improves your perspective.



*Brown-faced Katydid. A 40-exposure focus stack.*

ONCE YOU HAVE CAPTURED your series—you need to stack them. Onward!







## SOFTWARE

### WHAT WE LOOK FOR IN FOCUS STACKING AND RAW DEVELOPER SOFTWARE

As far as stacking software is concerned, I (Kaisa) look for the ability to further edit each layer manually after the stack is performed. It is essential to have this control for it is, after all, only software and it doesn't have eyes, cannot read your mind, make artistic judgements or creative decisions. It is bound to include blurred areas, and exclude sharp bits. Sometimes a stack will need hours of repair, sometimes only half an hour. It is entirely image dependent.

#### Focus Stacking software

Some focus stacking software that I have used at time of writing:



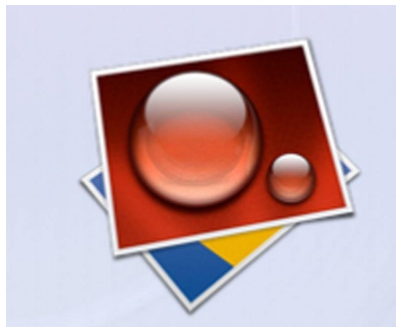
· [Zerene Stacker](#) (Mac & PC) My favourite for some years now.

For more information on using Zerene Stacker, there are some technical but very helpful pages on their site:

[Zerene Getting Started](#)

[Zerene Tutorials](#)

[Zerene's FAQ page](#)



· [Helicon Focus](#): Lite, Pro or Premium from HeliconSoft (Mac and PC). Works very similarly to Zerene, similar control.

· [Photoshop CS4 - CS6](#) (I have a sneaking suspicion this is no longer do-able in more recent incarnations):

In **Bridge**:

Tools > PS> Load files into PS Layers



Or in **PS**:

File>Scripts>Load Files into Stack (option to align),

then:

Auto Align layers,

then:

Select all layers > Edit >Auto Blend layers

---

## **What about your RAW developer?**

We use Phase One's [Capture One Pro](#):

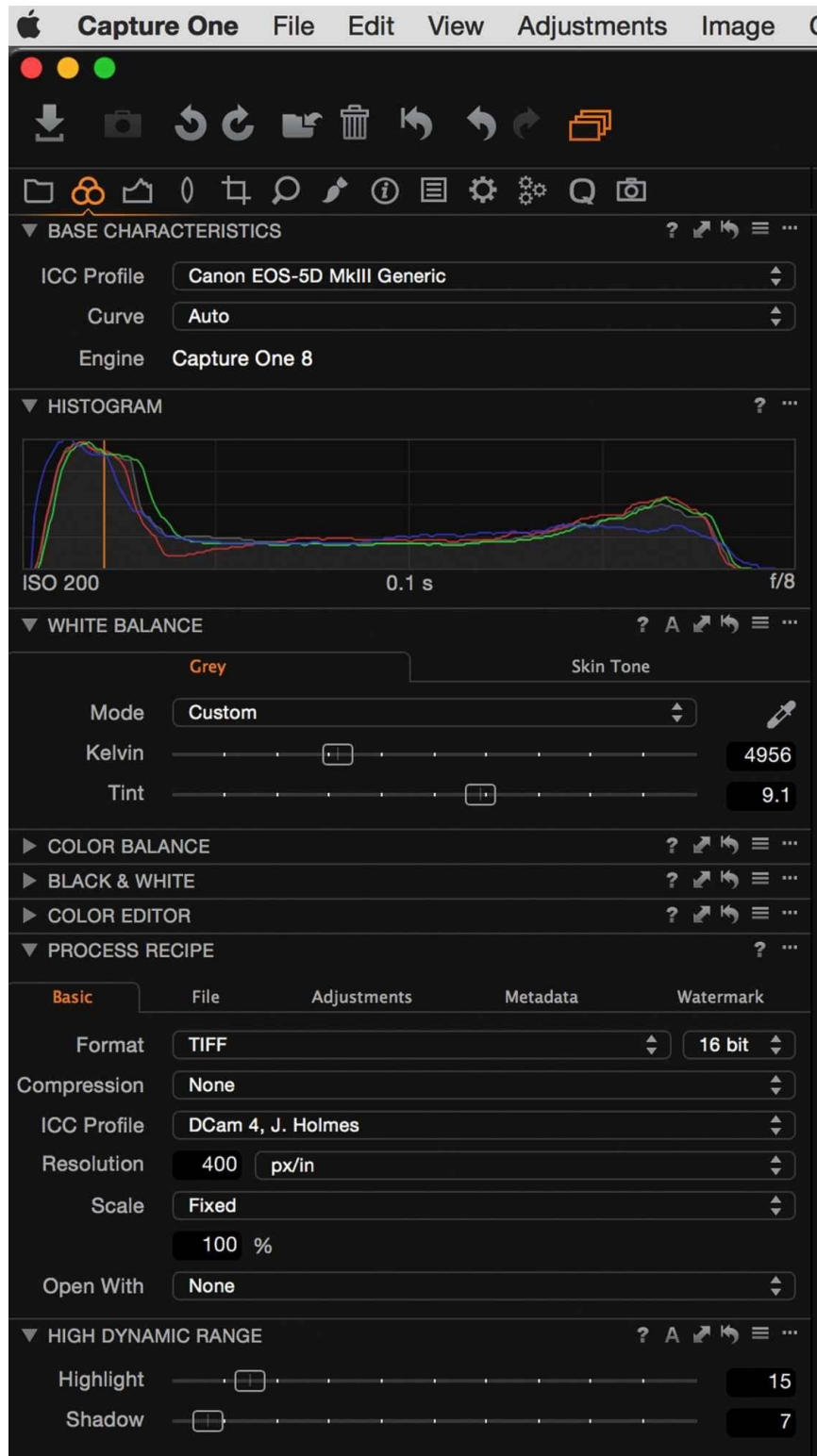


*Capture One Pro by Phase One*

W<sub>HY NOT</sub> A<sub>DOBE</sub> L<sub>IGHTROOM</sub>, or something else? Capture One Pro lets you specify *any* colour profile you like for your conversion from RAW to output space (rather than just the ubiquitous catch-all ProPhoto RGB or Adobe RGB or sRGB):



*Capture One Pro: note DCam4 by Joseph Holmes specified as the output profile in the Process Summary.*



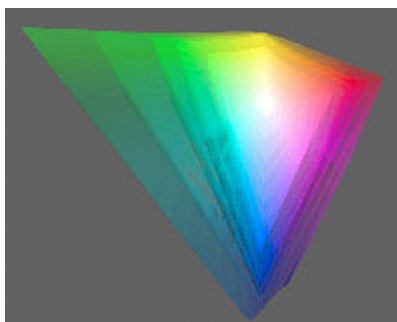
*Capture One Pro's colour tab: you can select different ICC colour profiles in the Process Recipe, and see the histogram update accordingly.*

It's not a program with the power, flexibility or file management capabilities of Capture One Pro, but [Iridient Developer](#) by Iridient Digital is the only program we know of that lets you specify *any* colour profiles you like at *both* ends of your workflow. *And* conversion methods! Bliss! For that reason alone it is well worth a look:



*Iridient Developer: take control of your colour*

WHAT OTHER KINDS of profiles am I interested in using, you ask? All of the Dcam working spaces by [Joseph Holmes](#). This is for fine editing in Photoshop, and beyond the scope of this book. Don't freak out about this, it's not needed for focus stacking, I just mention it because I'm a colour nerd.



*5 Dcam Spaces by Joseph Holmes*







## OUR TECHNIQUE: PROCESSING

We're going to be using terms like 'mask' and 'retouch' here. Don't be intimidated. Basically, once you have completed a stack (or several versions of it) you are going to 'paint' from one file (your 'Input' or 'Source' file) into your stacked ('Base') file to get the best result possible.

You'll also see Pmax and Dmap mentioned. They are just two different methods of stacking, yielding different results.

### Develop RAWs and export as Tiffs

In your chosen RAW developer, scrutinise your shots for sharpness & movement. View them at 100% to do this.

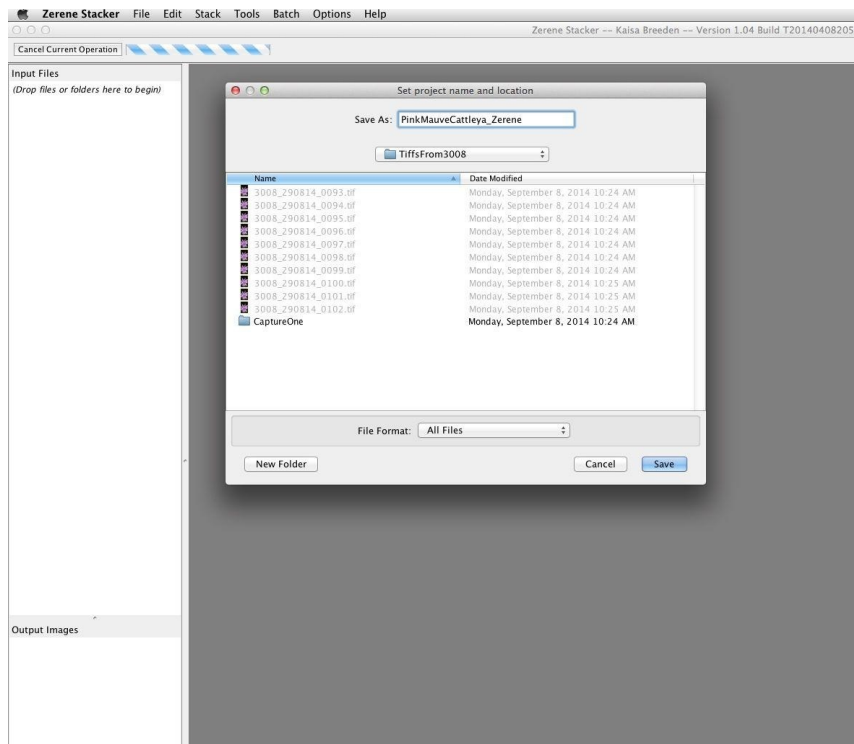
Develop RAW files in your favourite RAW developer (I use Capture One Pro, as mentioned in the 'Software' chapter).



*Tiffs exported from CaptureOne Pro, viewed in Adobe Bridge*

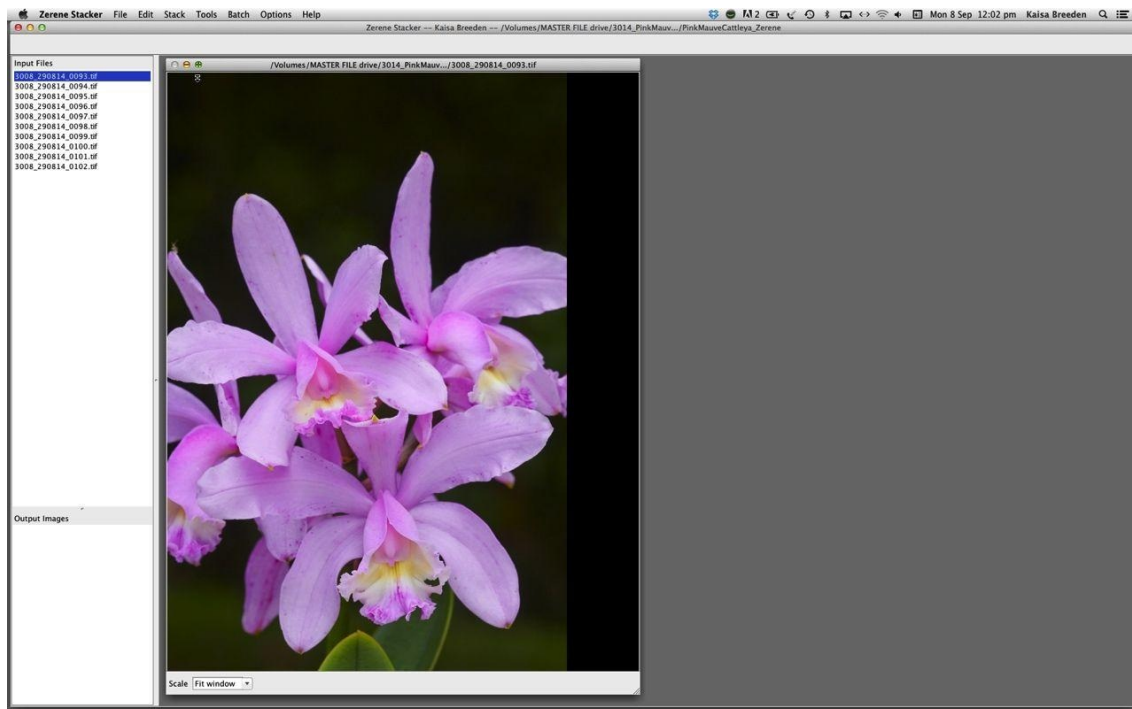
### Bring Tiffs into Focus Stacking software

Now we open the Tiffs in our stacking software, in this case [Zerene Stacker](#). You do this in the main menu, File > Load Files, or you can select them and drag them onto the open "Input Files" panel of the open application. It will ask you to name the project, which I append with "\_Zerene" to make it easier to identify later.



*Importing Tiffs into ZereneStacker and naming the project.*

Once files are loaded, before you do any stacking, enlarge the window and have a quick flick through the Input/Source pics (just press and drag through the list) to determine if there is any movement. It's always good to double-check.

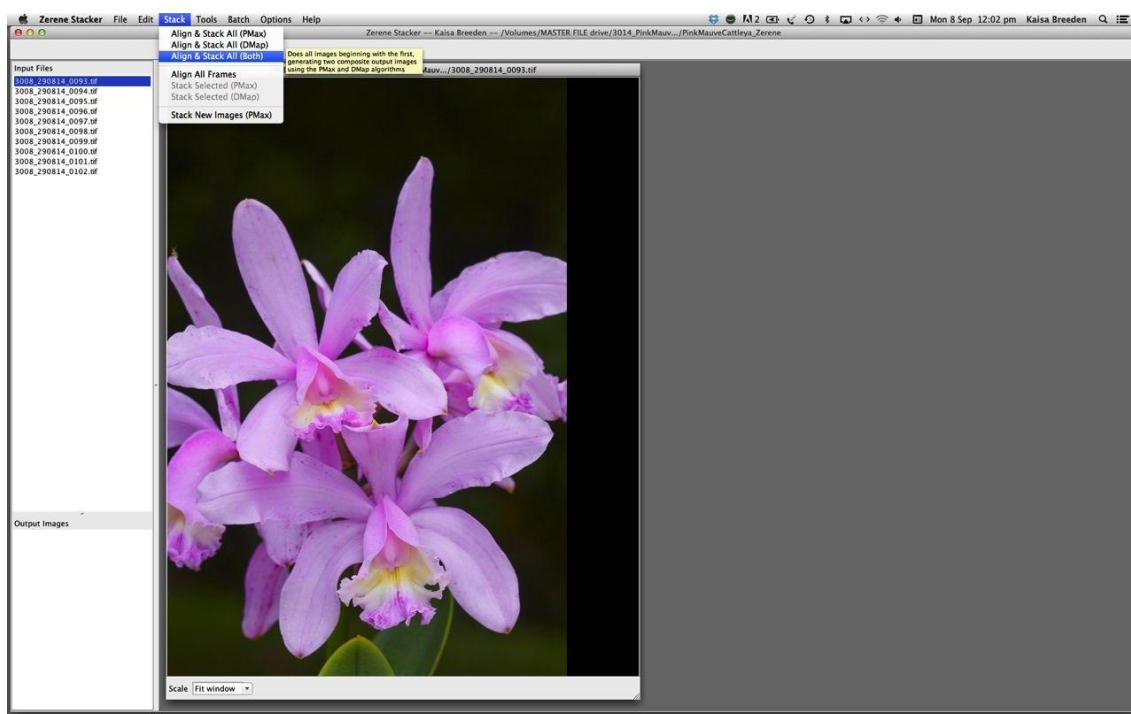


*Tiffs loaded in ZereneStacker*

If there is movement visible, creating a good stack is well-nigh impossible and you may well have to shoot the series again. Sometimes the movement is in an area that is covered well in another exposure though, so all may not be lost. In this case, you could select just the sharp files and Stack > StackSelected (Pmax or Dmap: see below for details on these two stacking methods).

## Generate the stack

Now your Tiffs are loaded in Zerene, select Stack > Align & Stack All (Both). This means you will be stacking with two stacking methods, PMax and DMap (read below). I always hedge my bets and do both.

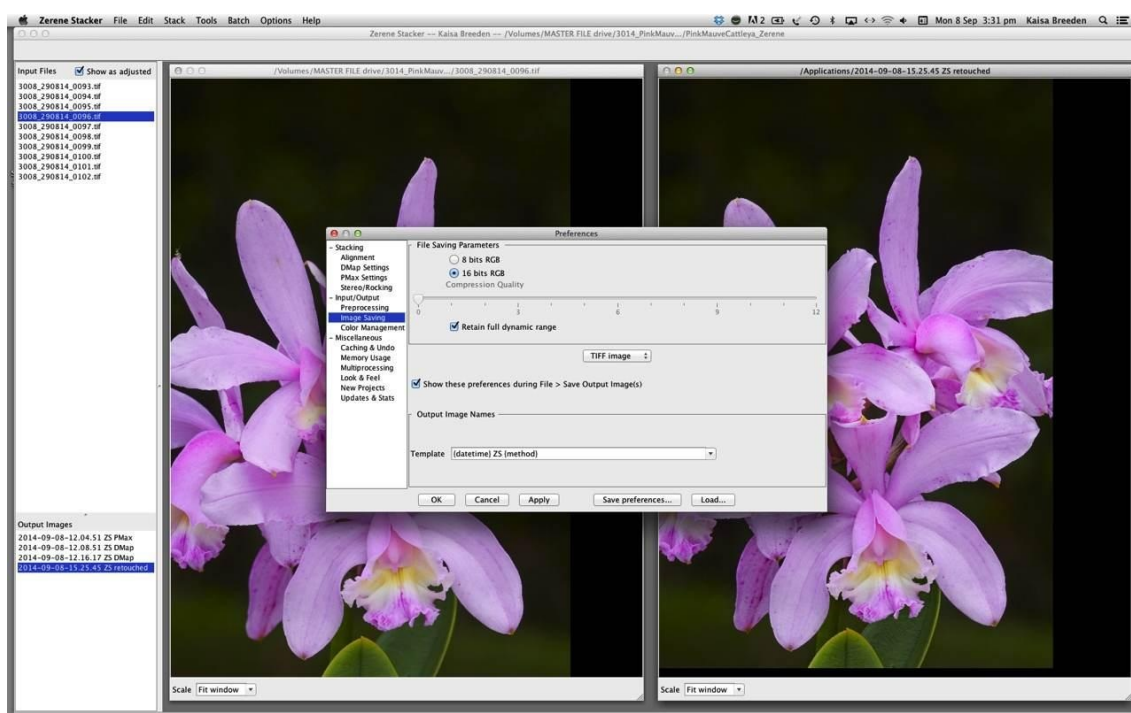


*Stack > Align and Stack All (both)*

## PMax and 2 DMap: What the Dickens?

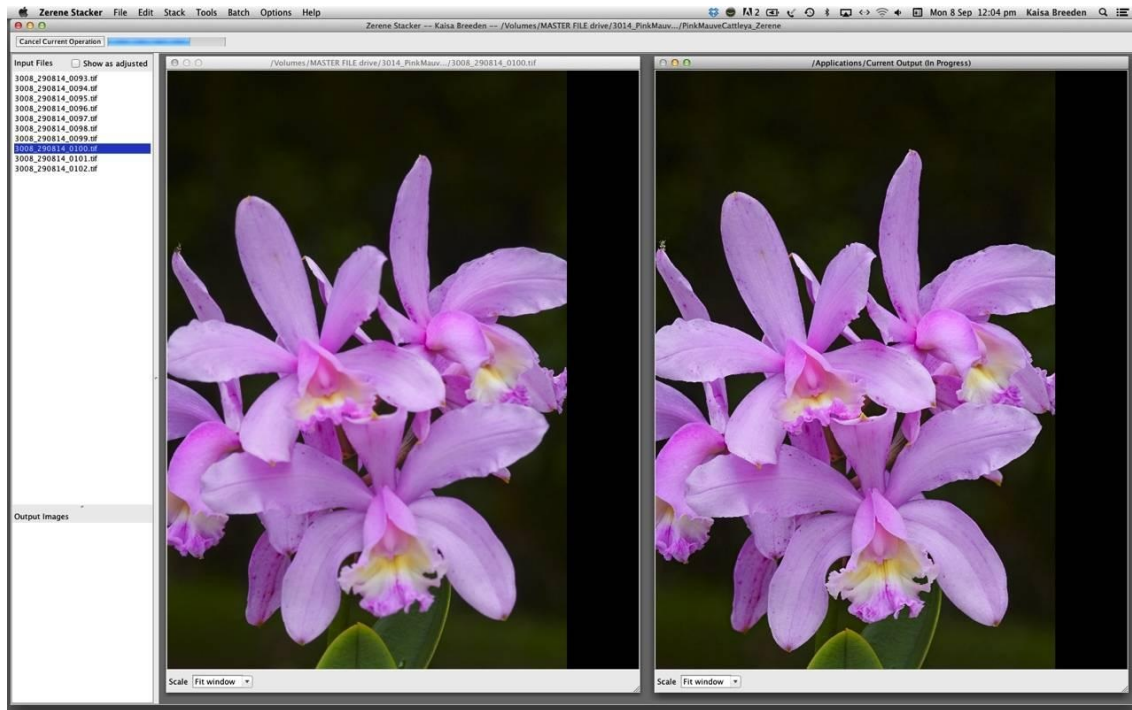
These are simply two stacking methods. Both have strengths and weaknesses, so I usually use both and end up combining the results.

**PMax:** For overlapping detail, but can increase noise, create colour shifts and halos. PMax stacking method often causes contrast to increase, pushing darks darker and brights brighter. So in Preferences, check “retain full dynamic range” is selected (see image below):

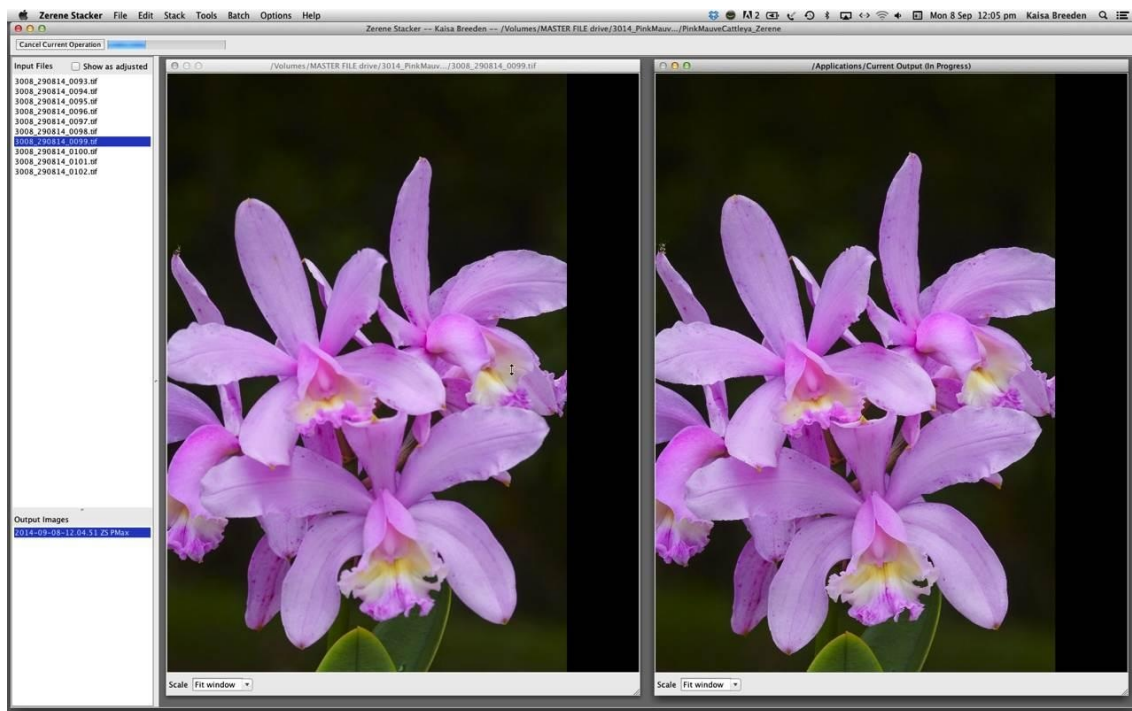




### Selecting “Retain Full Dynamic Range” in Preferences of Zerene Stacker.



*PMax stack in progress: currently selected file on the left, and Output Preview on the right.*



*PMax completed (see it listed in the Output pane bottom left), and a DMap in progress.*

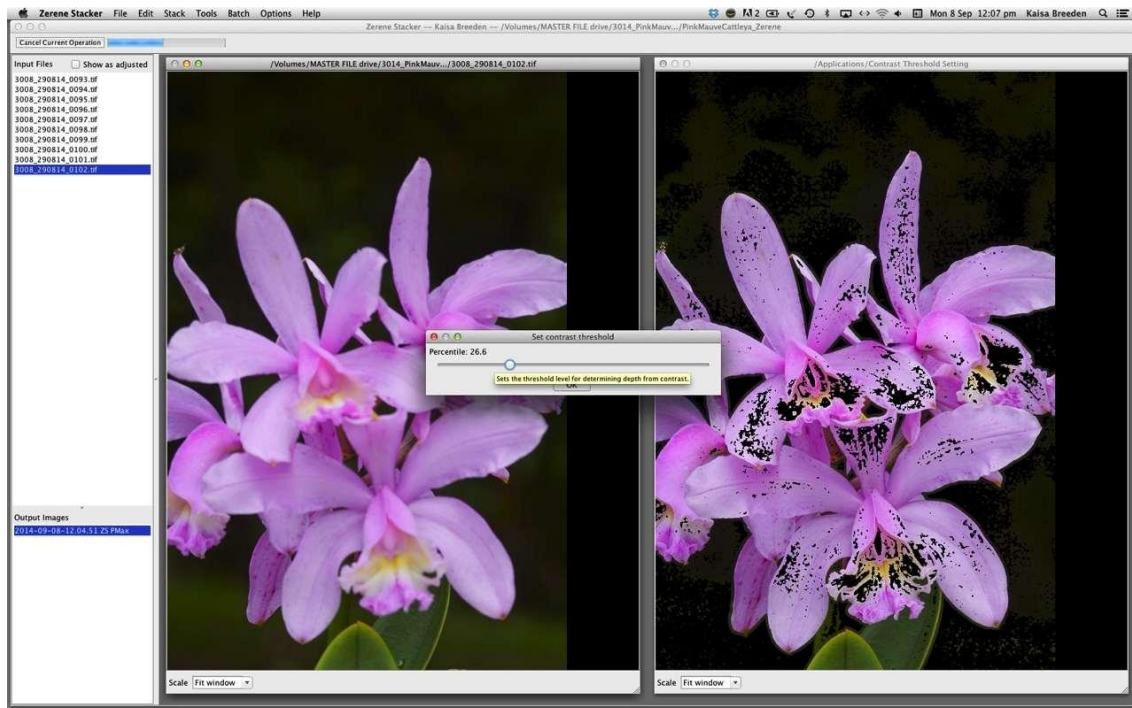
**DMap:** This stacking method preserves smoothness and colour, but detail can be messy. Sometimes you end up with artifacts like spots or splodges. Once Dmap is in motion, you will be asked to manually set the Contrast Threshold with a slider (which separates details from noise).

The stack is quickly processed and then presents you with a Contrast Threshold Percentile slider for your input into what matters in the pictures. **Percentile** is image dependent: your aim is to “black out” blurred areas or junk and noise, and retain as much sharp detail as possible. DMap only works well in regions that contain significant detail. In areas that do not contain significant detail, like a blurry background, DMap will end up



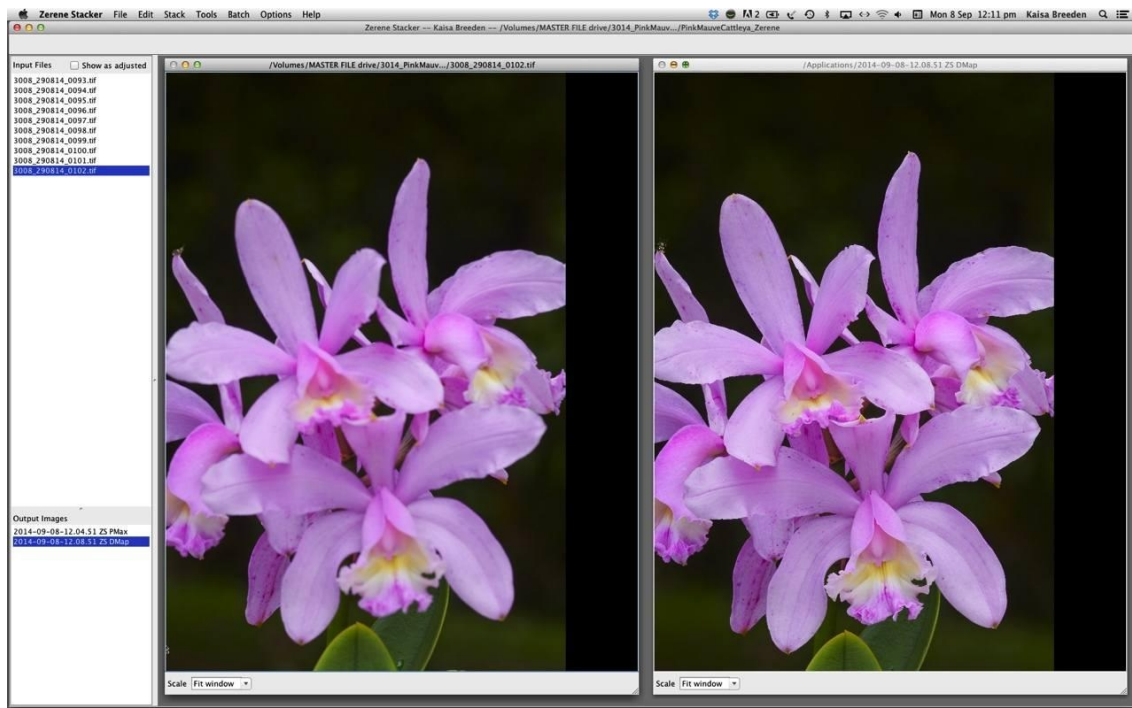
paying too much attention to noise and is liable to produce halos and blotches.

What we need to do at this point is to adjust the slider so that we get clean borders, especially where the subject is silhouetted against very blurry background. In the right-hand preview panel, areas that are considered to not contain significant detail are shown in black. The aim is to adjust the slider so as to make the out-of-focus background go black, along with whatever halos might be in it, while leaving most of the subject revealed.



*First DMap showing Contrast Threshold Percentile slider*

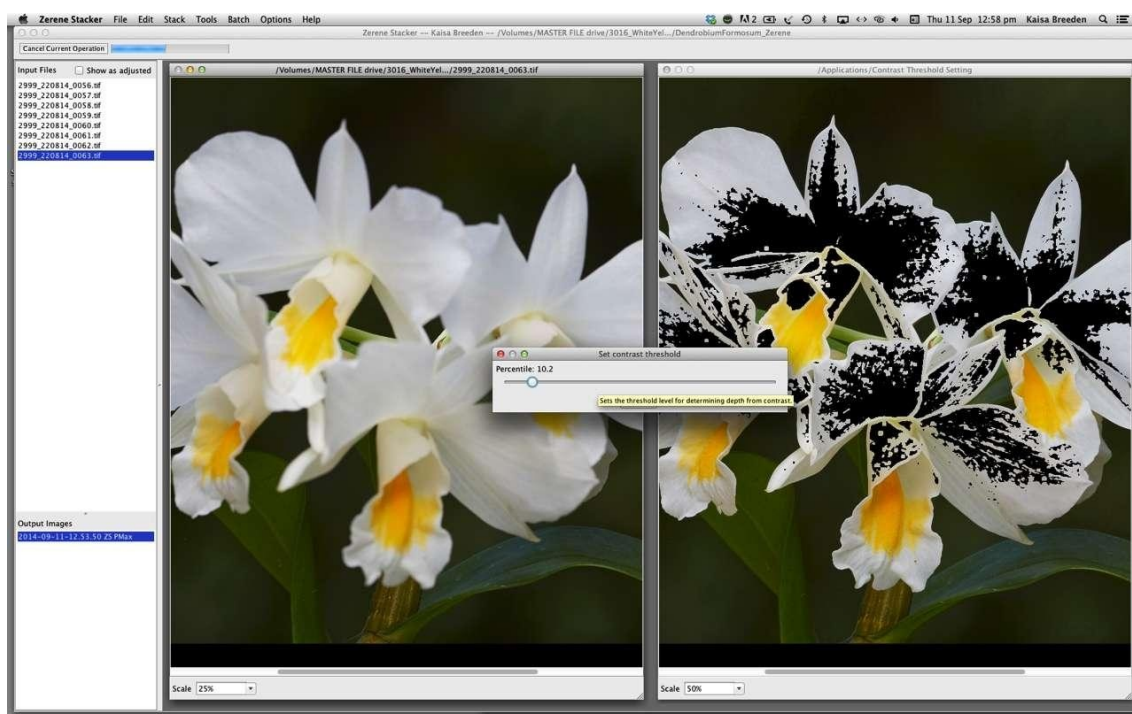
Then you let the DMap process run.



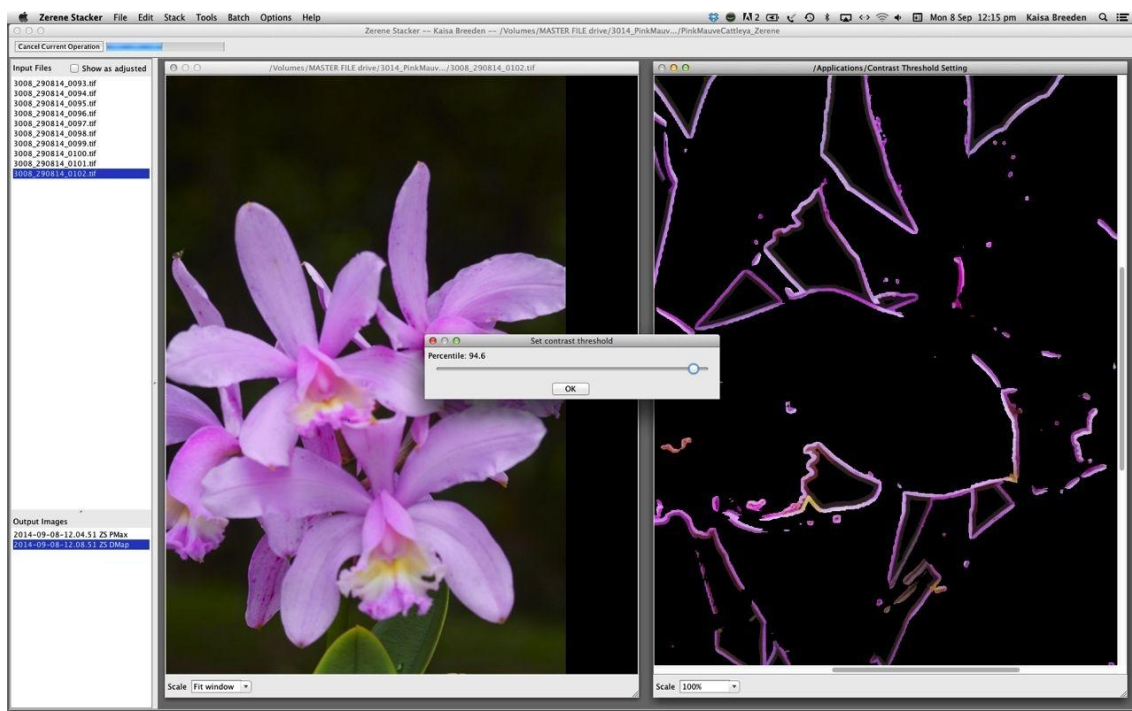
*A DMap completed. See it listed in the Output pane on the left.*

Sometimes, you'll get an image that seems to do the reverse: ie. The percentile slider blacks the subject out rather than the background. If this is the case, set the % slider to

cover as much of the subject as possible before it starts “speckling” out into the background. And view it at 100% to refine the % setting further. See the white orchids below:



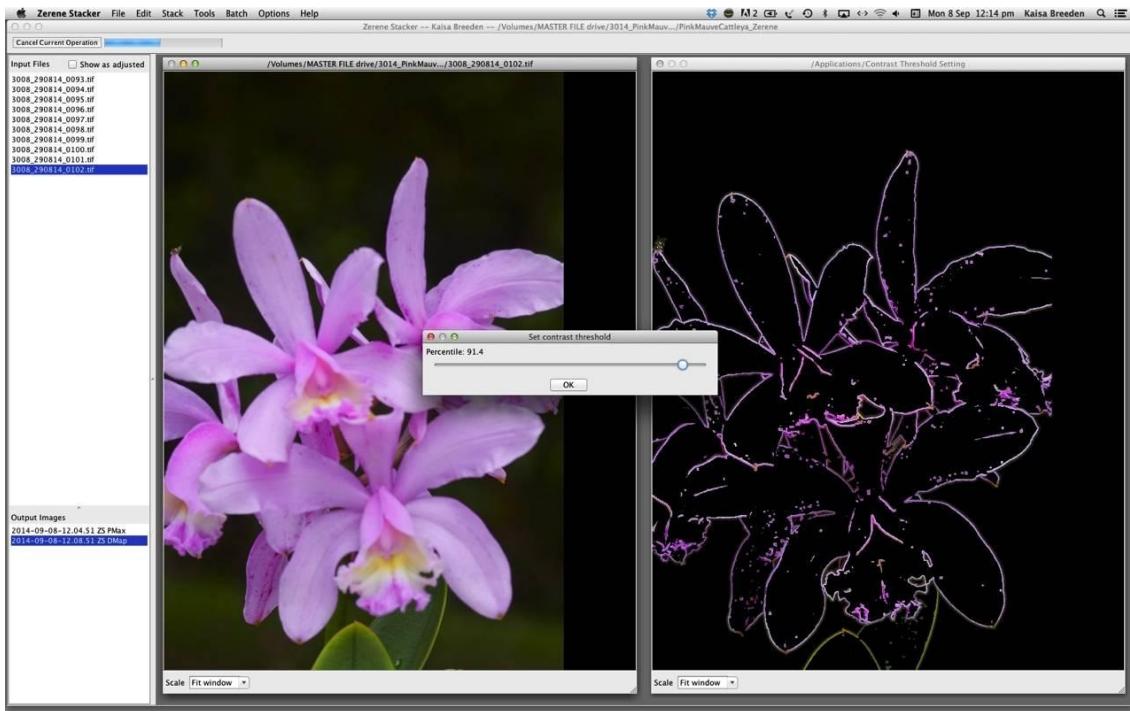
*An example of Percentage covering the subject rather than the background.*



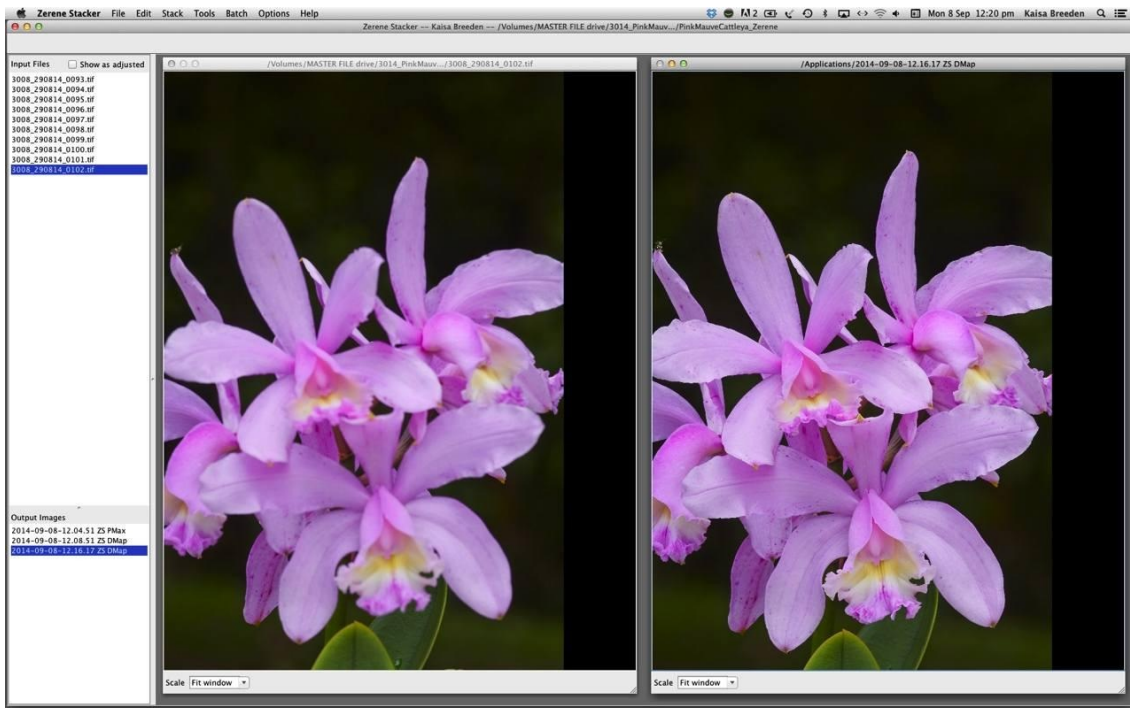
*Checking the DMap at 100% view before committing the Percentile setting.*

I ALSO CREATE A 2<sup>ND</sup> DM<sub>AP</sub>, optimized just for the edges of my subject: in this case, I increase the percentile to something much higher (sometimes it is 80-90%), till just the outlines or edges are visible, and all else is blacked out.





*A second DMap in progress, optimized for the edges of the subject.*

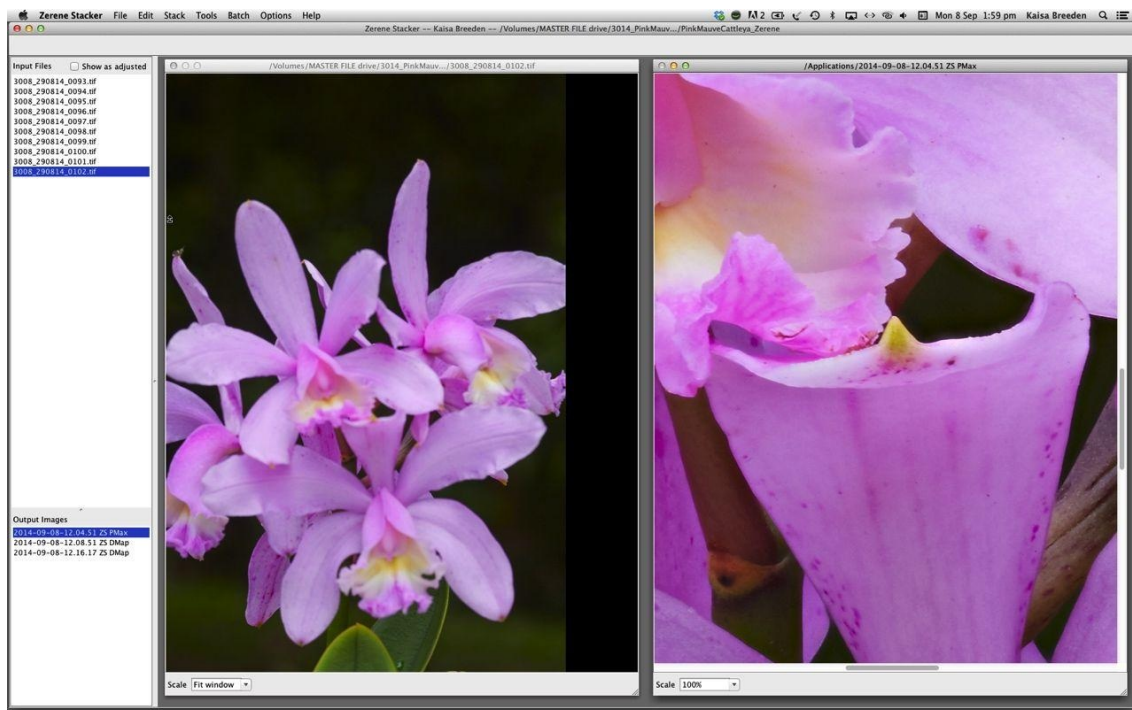


*Second DMap completed. See it listed in the Output Images pane on the left.*

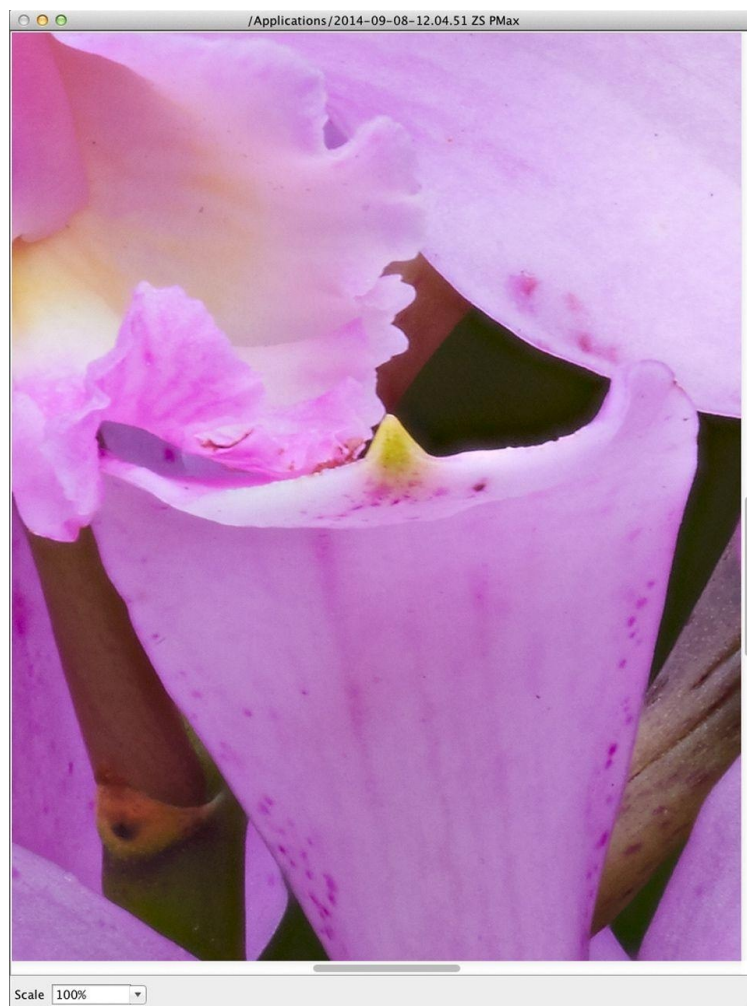
## Choose your 'Base' image to build on

Select your preferred Output image (from those listed in the Output pane at bottom left) to be used as your Base. Whether this be a PMax or DMap is up to you: it depends on the results you get, and these are different for each session.

To do this, take a look at each at 100% view to decide which is best to use as your Base:

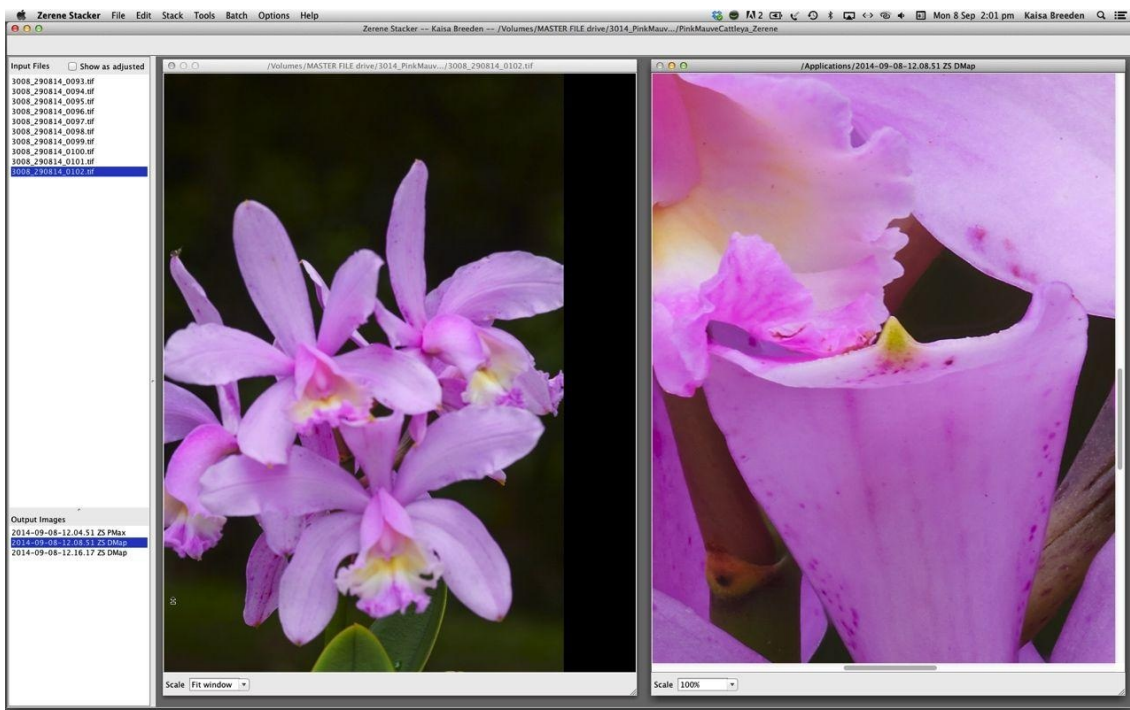


*PMax Output selected and scrutinized at 100% view.*

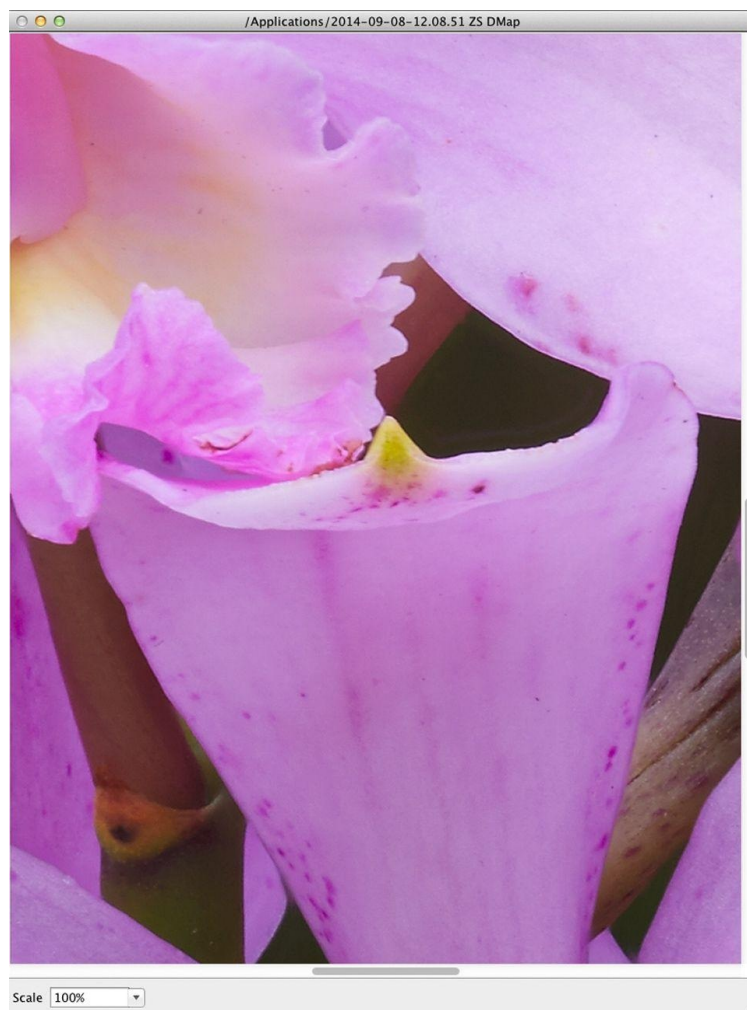


*PMax viewed at 100%.*



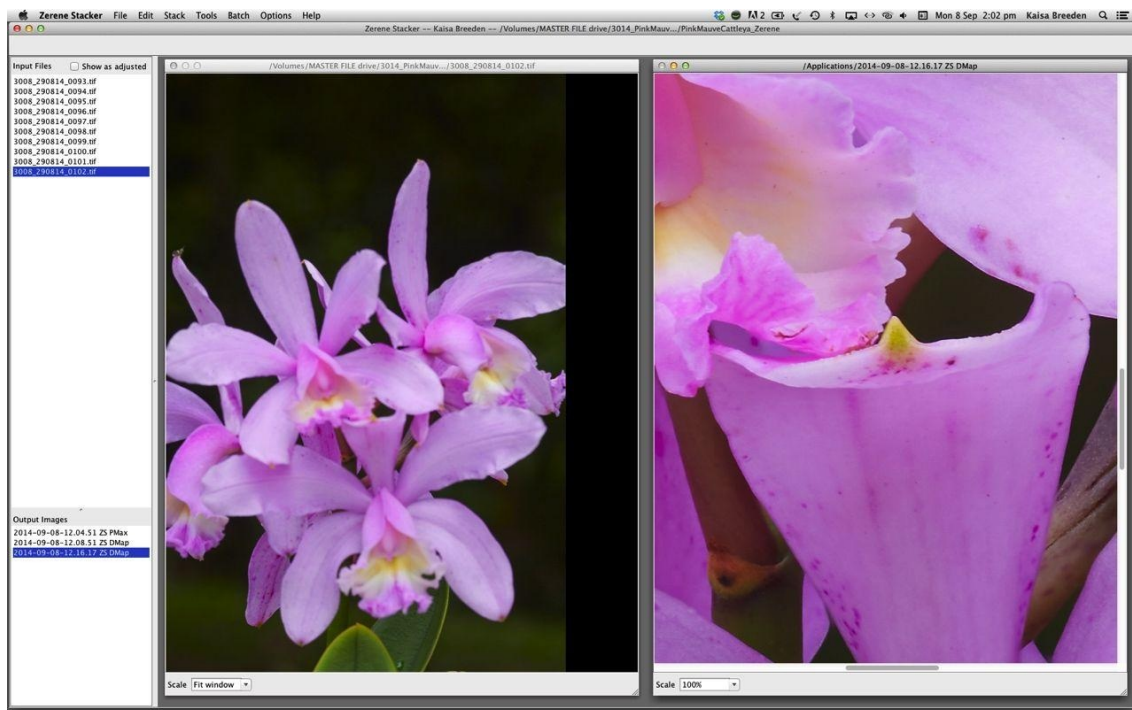


*First DMap Output selected and eyeballed at 100% view.*

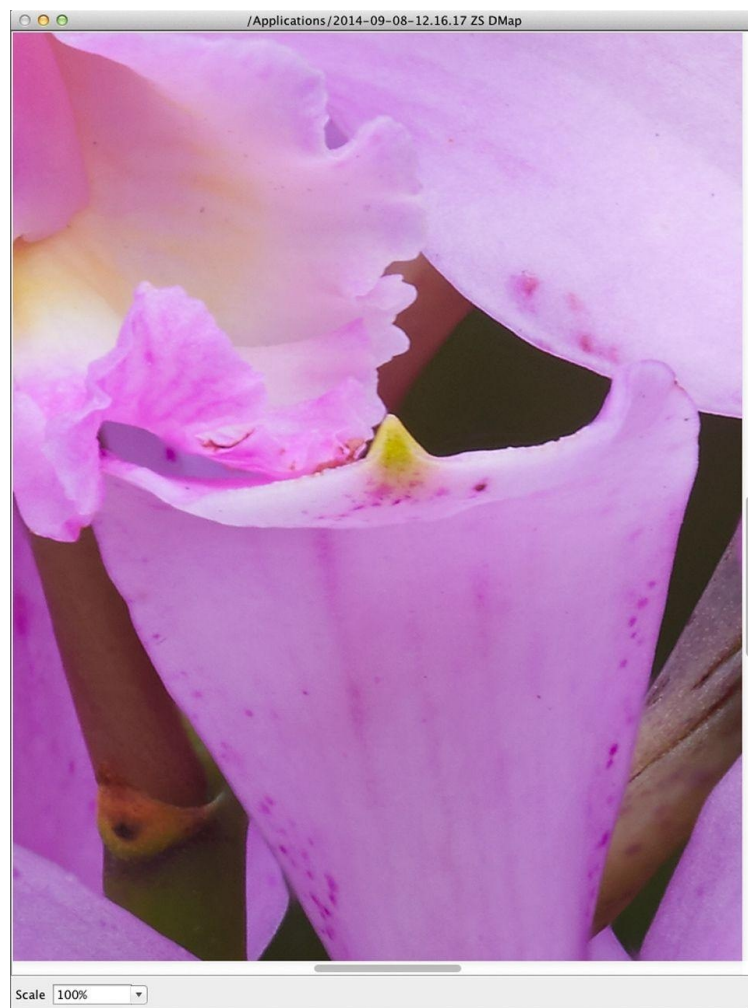


*First DMap viewed at 100%*





*Second DMap Output scanned at 100%*



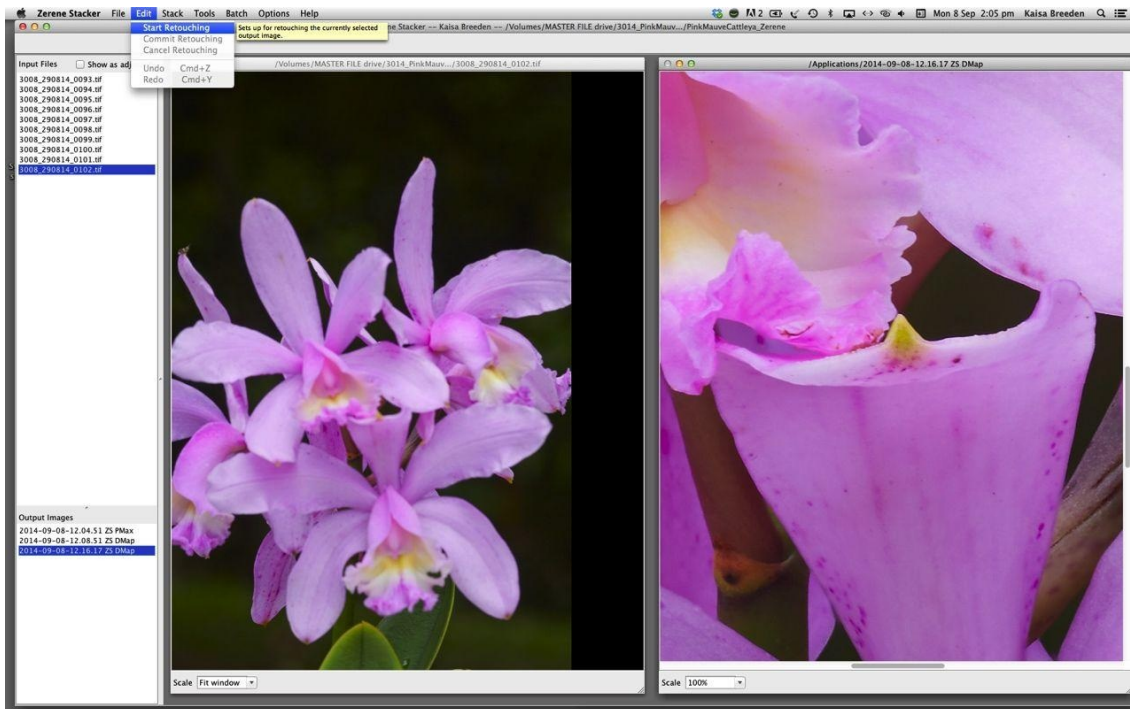
*Second DMap viewed at 100% to check edge detail.*

## **Start Retouching in Zerene Stacker:**

You'll be adding details ('Retouching') to this Base file from *any* of the Input *or* Output files listed to the left.

Retouching, masking or repairing is just ‘painting’ from one left-hand file (used as a ‘source’) into your final ‘Base’ file.

So, with your chosen Base highlighted in the Output pane, select Edit > Start Retouching:



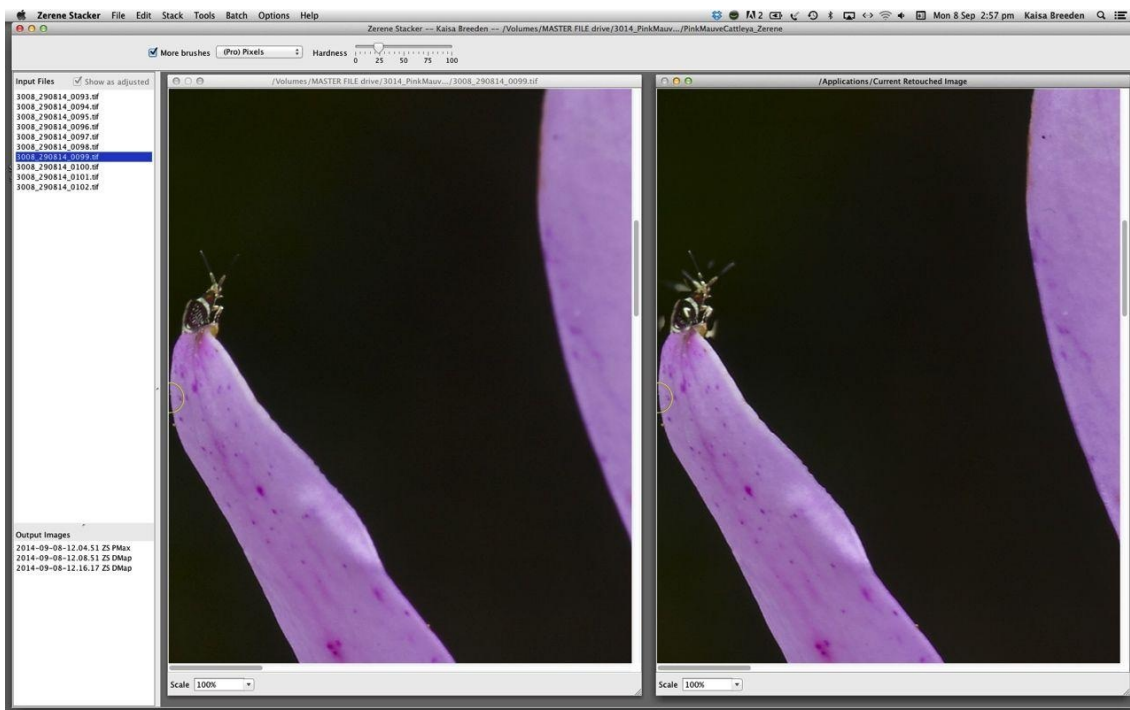
*Choose which Output you like best to use as your Base. Here I chose the 2nd DMap file. Then Edit > Start Retouching*

Look to repair “blobs” and haloes. Blobs can be hard to spot: you must scan right through the Base image at 100% view to do this.

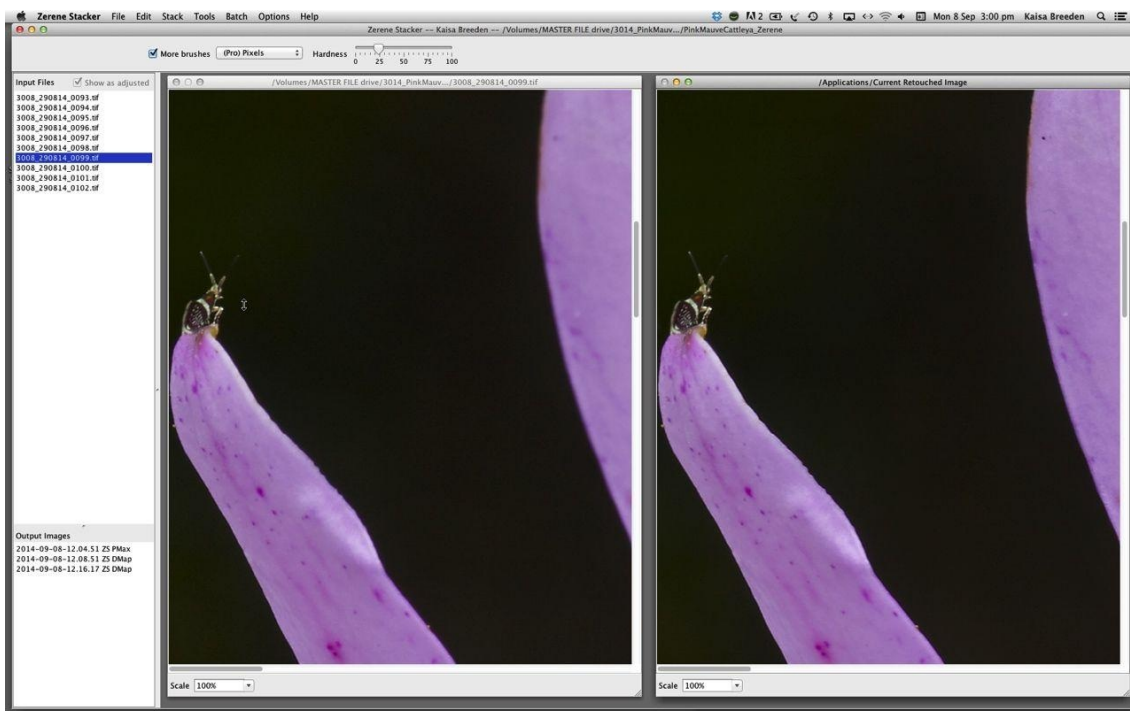
Once you find an area in your Base file you’d like to repair, scan through your Input files to see if any contain good replacement detail. You can select *any* Input or Output file from the panes on the left to mask into the Base, whether that be a PMax or DMap result, or one of the original files.

For example, you might select a shot that has a nice smooth background to mask into your Base. The Active image (the one you are sourcing from) is in the left window, and Retouched Base Image is in the right window (as shown below).

Your cursor becomes your paintbrush, and the size can be adjusted using your [ and ] keys.

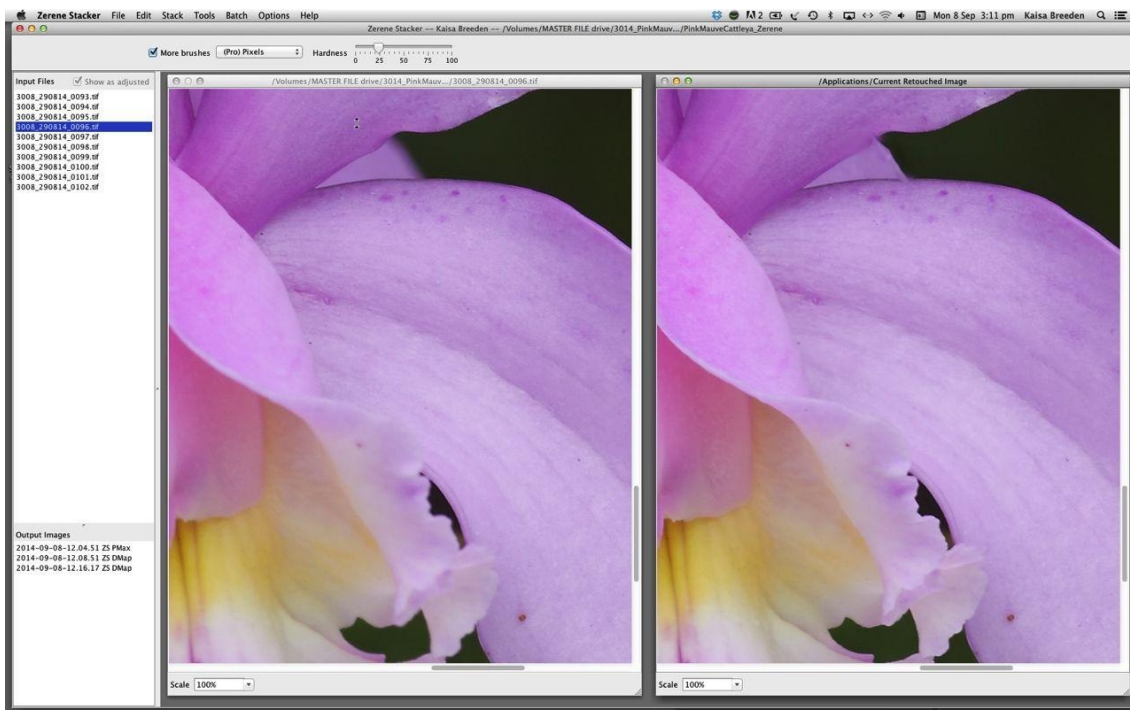


*An example of an area needing retouching, seen in the “Current Retouched Image” or Base file on the right. A Input (ie. Source) file to retouch from is selected in the list on the top left.*

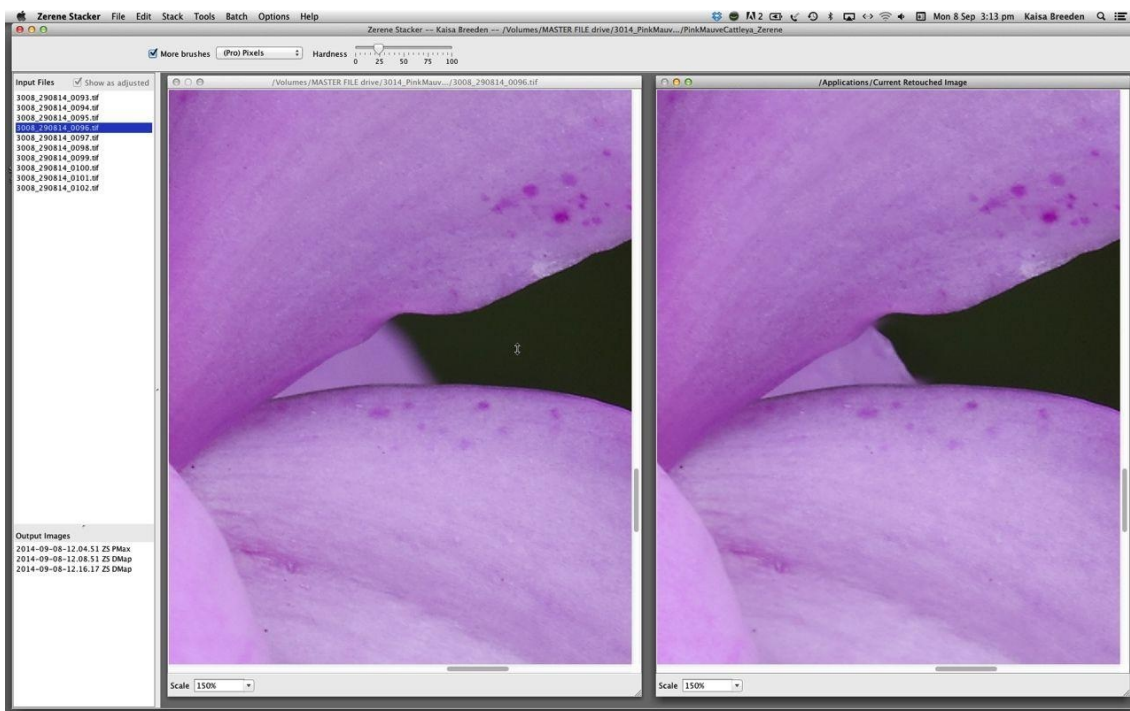


*Replacement detail painted in.*

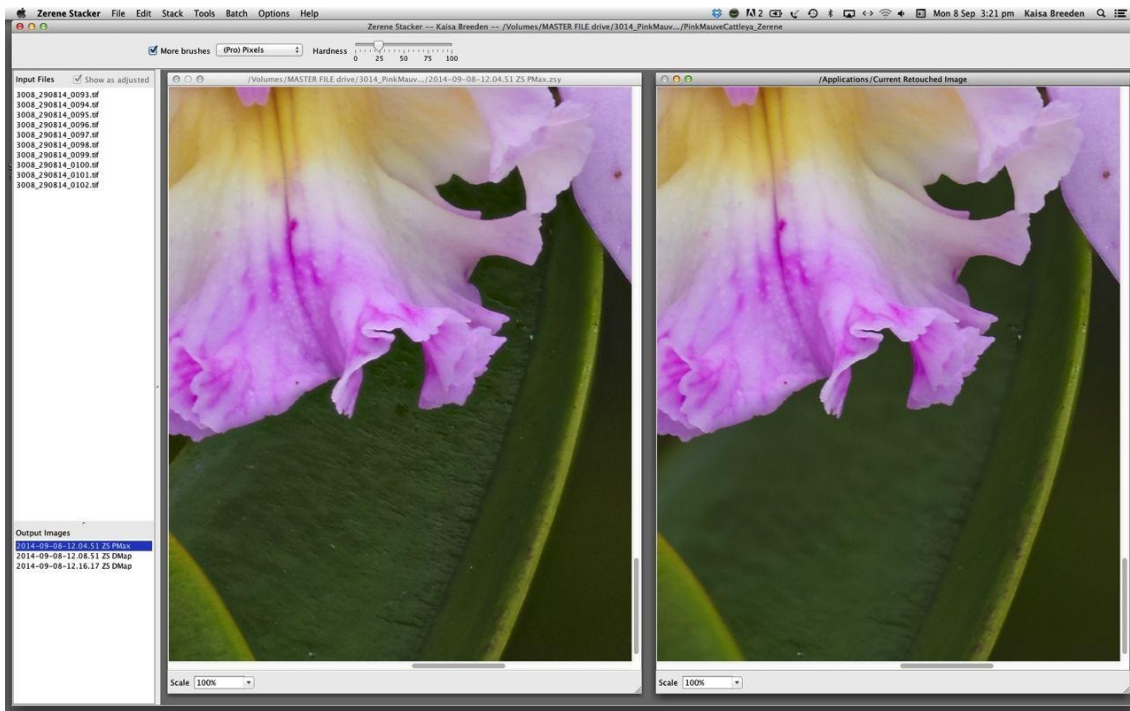




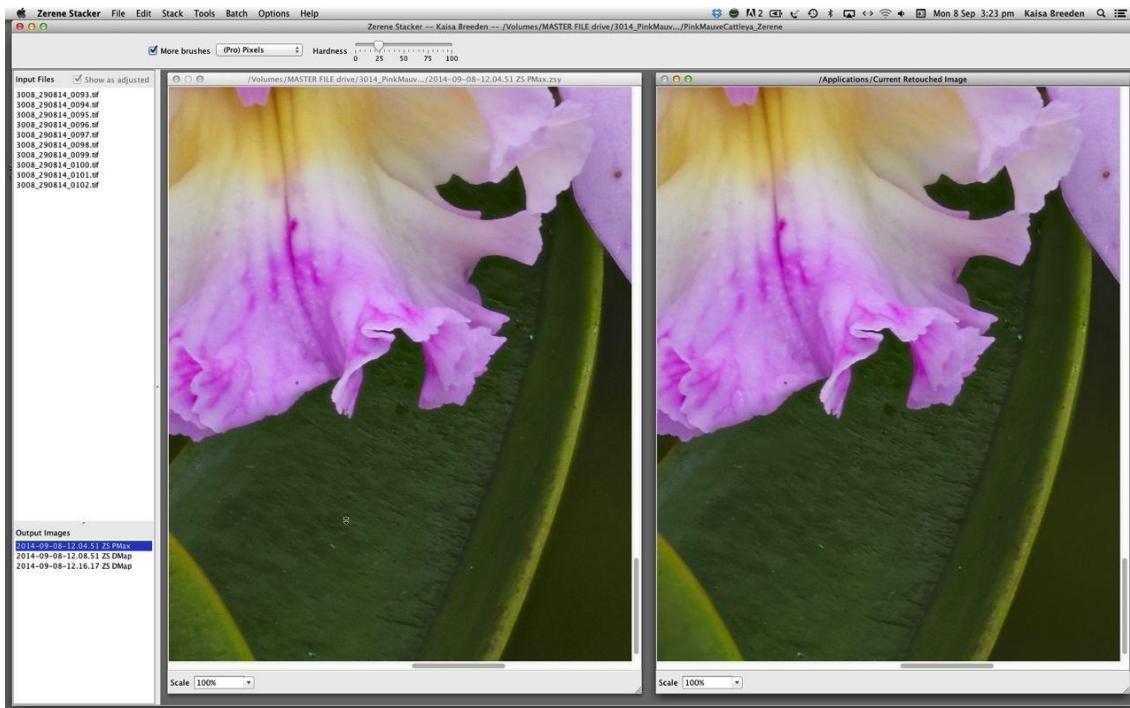
*An example of overlapped areas needing repair. The Input file on the left will be our Source, containing the detail to be painted in.*



*Close up (150%) of the repaired result. Better, but it will need further refinement in Photoshop (see chapter 'Editing Backgrounds').*



*Here, the PMax output is selected as a source file (left pane). Note the detail in the green leaf.*



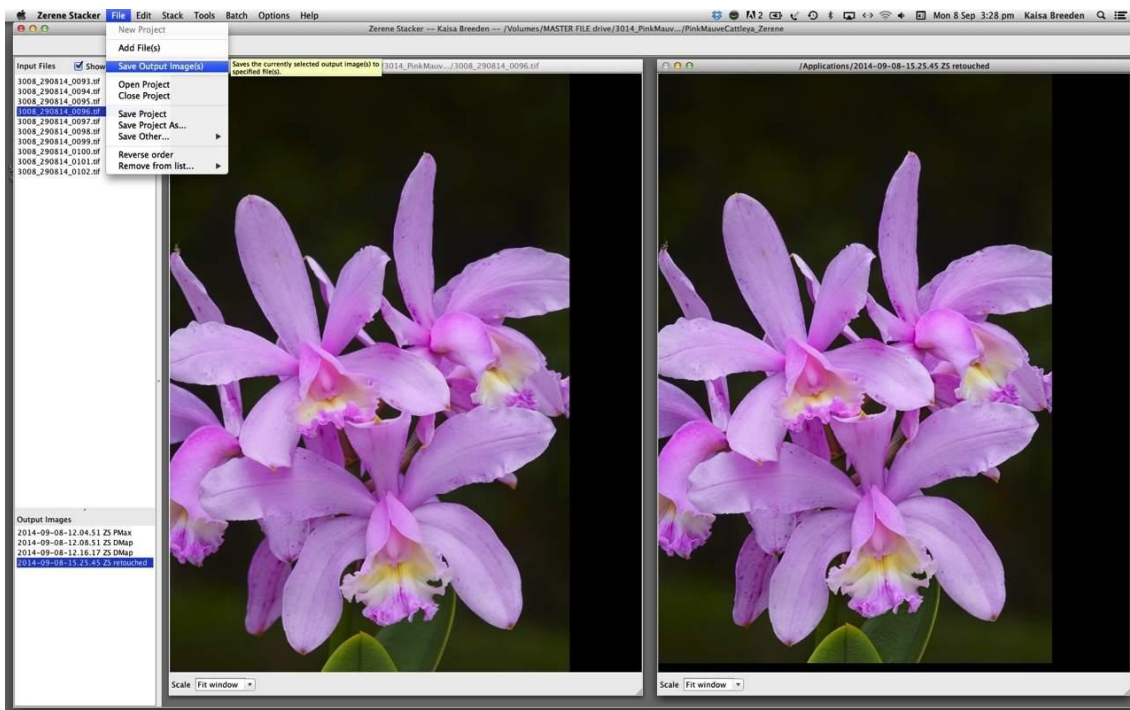
*PMax source detail painted into the Current Retouched/Base image.*

LASTLY, check the background for speckles or noise, and paint/mask in your second DMap (the edge optimized file), or select one of the individual shots with a nice noise-free background to mask in.

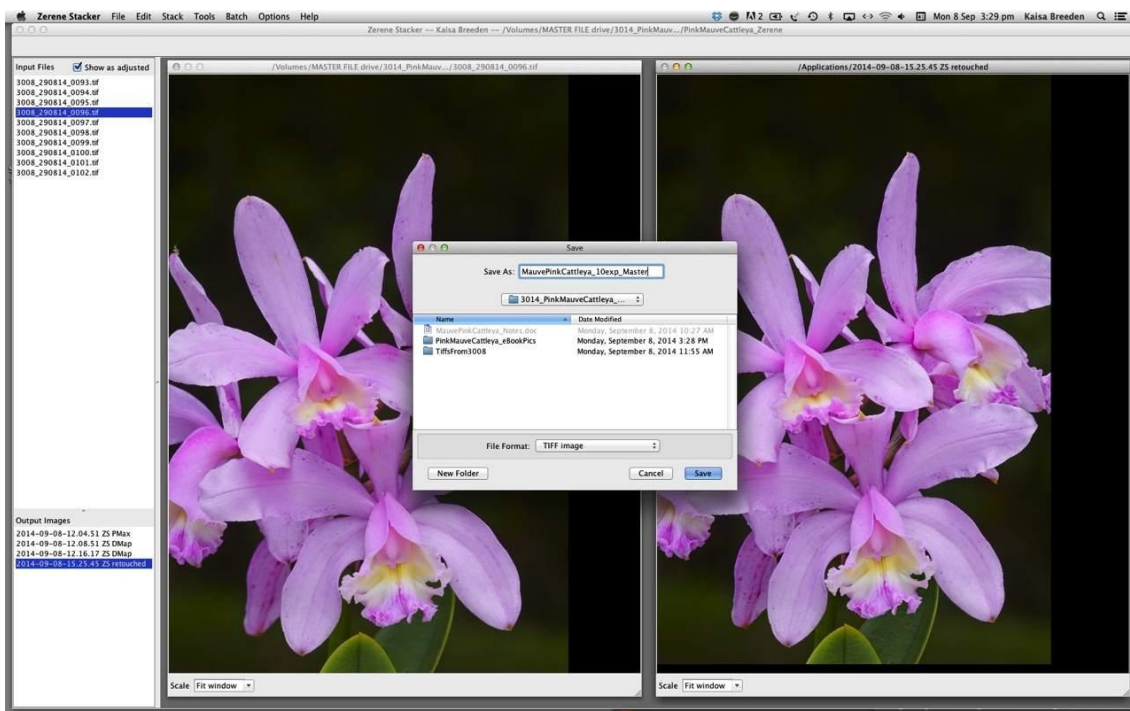
At any stage you can select Edit>Commit Retouching to save progress to that point. And you will be presented with a new Output image that you can select as your base when you resume retouching.



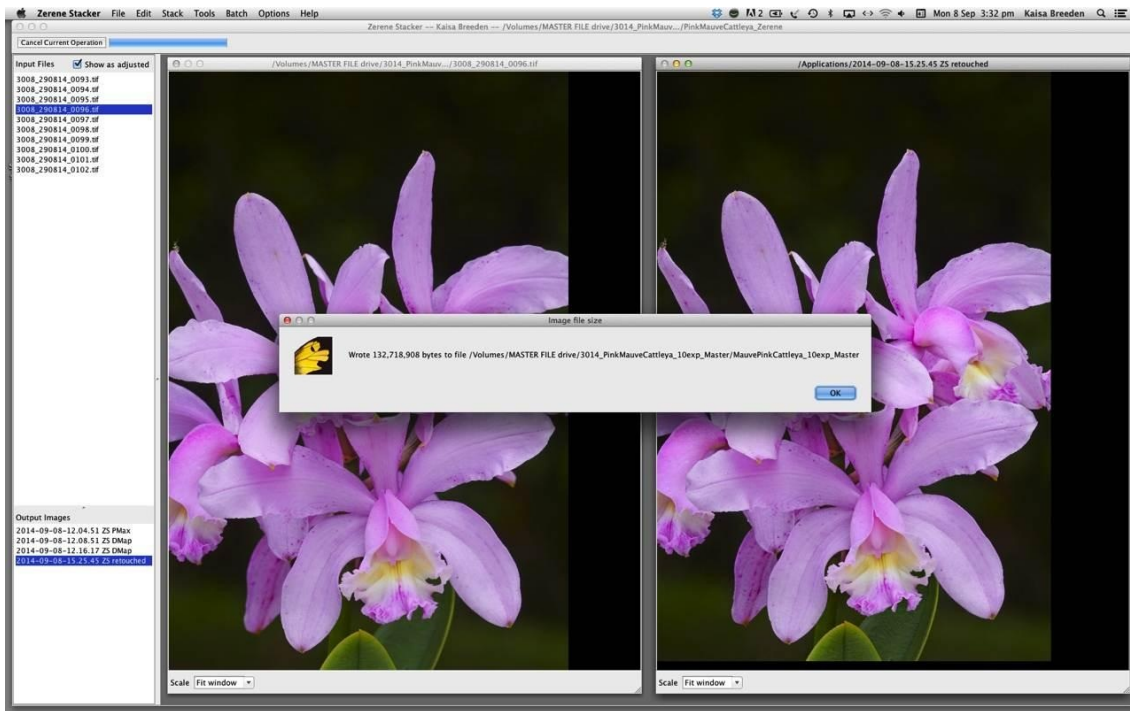




*File > Save Output Image to save your precious Retouched Base file.*

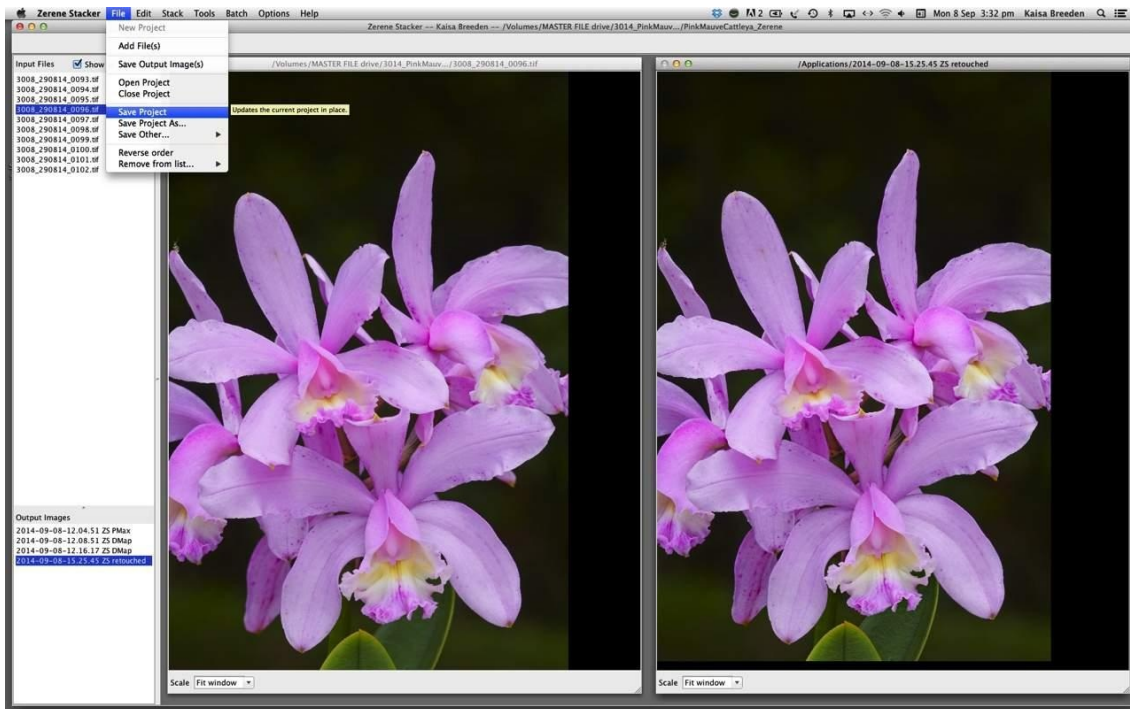


*Saving your Retouched Base file as a Masterfile: In the dialog box that pops up, I append my masterfiles with “\_Master” for easy identification.*



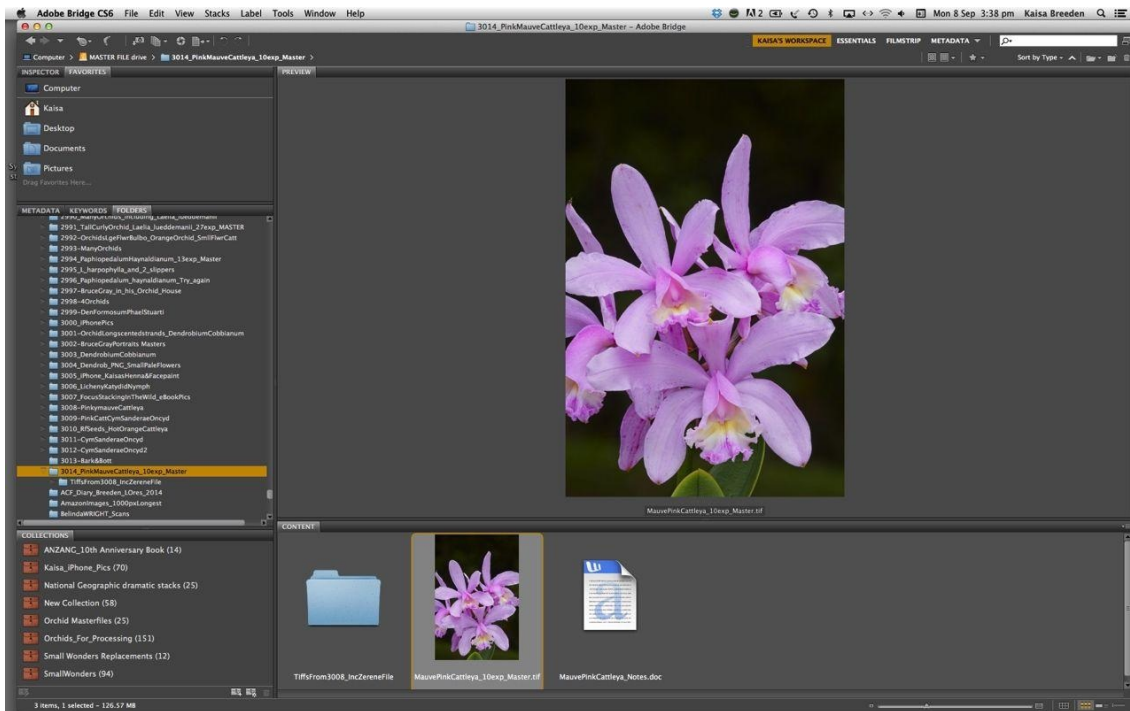
*New Masterfile saved.*

Before quitting Zerene, select File > Save Project to save all work, so that you can go back and re-visit the Zerene project with all its source files if necessary.



*Saving your Zerene Project.*



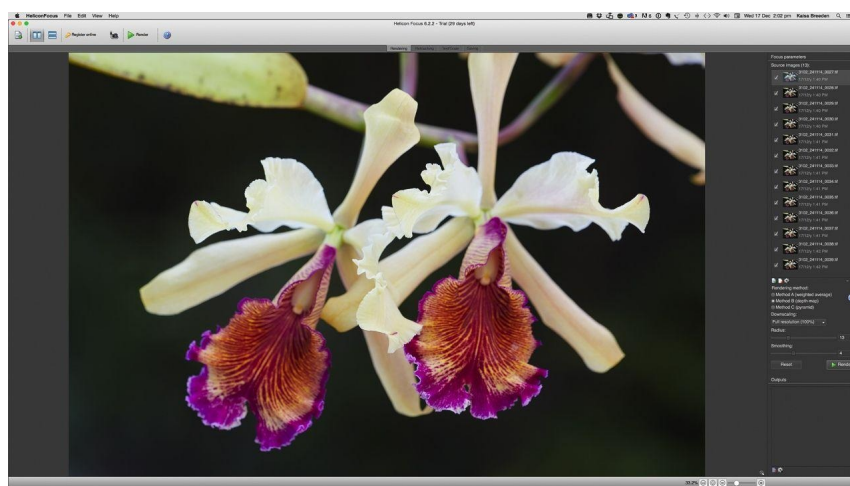


*The finished Masterfile, Zerene project folder and my notes as viewed in Adobe Bridge.*

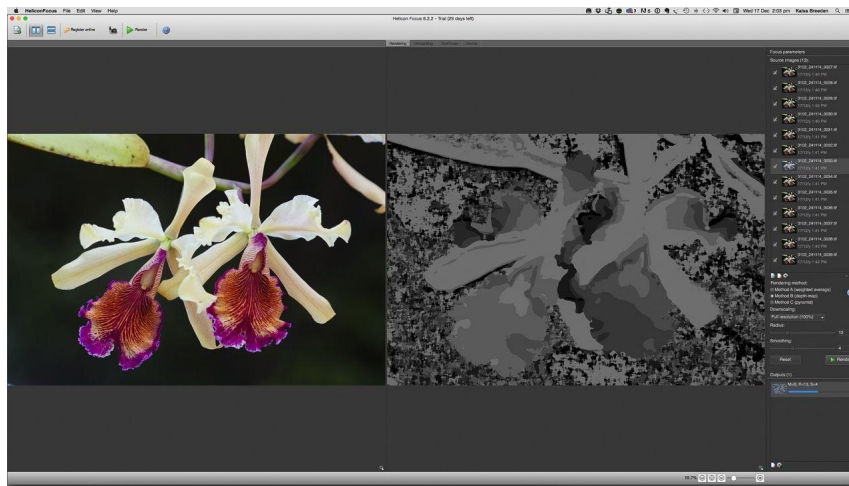
The 'Notes' file you see in the shot above (a Word document) contain information about the date the stack was taken, the subject, the RAW developer used, the Source files used, the stacking software and settings used, and screenshots of edits made in Photoshop for future reference. Overkill for some, perhaps, but I've found these records to be solid gold and a great learning tool.

## Comparison with Helicon

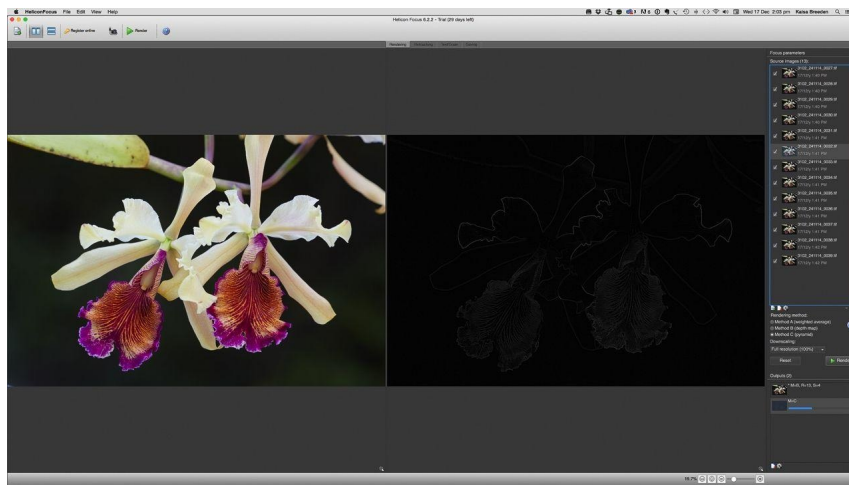
I find Helicon to be very similar in use to Zerene, but it has 3 stacking methods. Here I've used two.



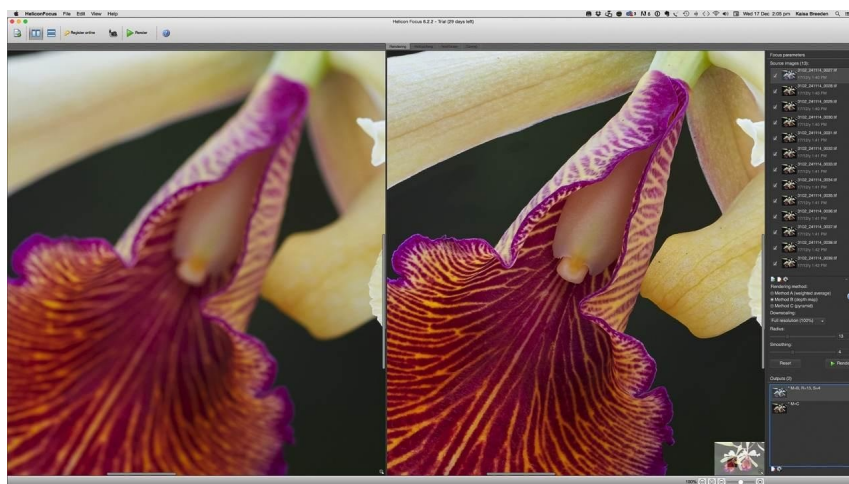
*Helicon: Files loaded and ready to go.*



*Helicon: DMap method in progress.*

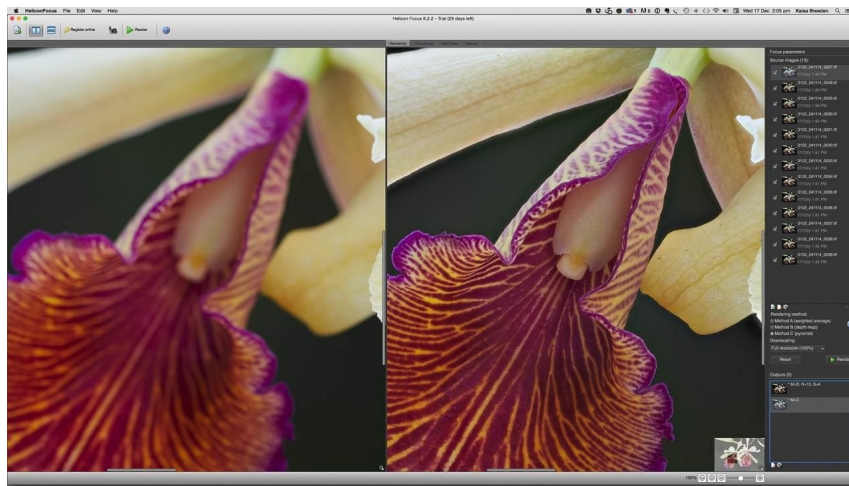


*Helicon: Pyramid method in progress.*

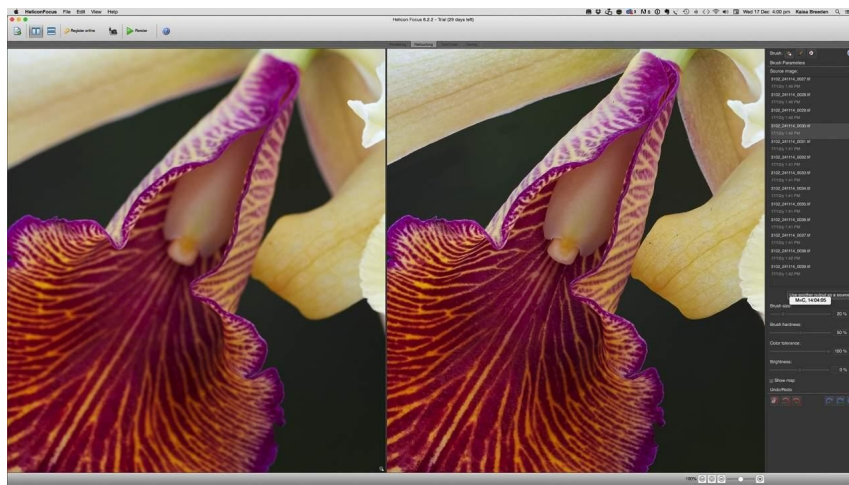


*Dmap result viewed at 100% (right hand window)*

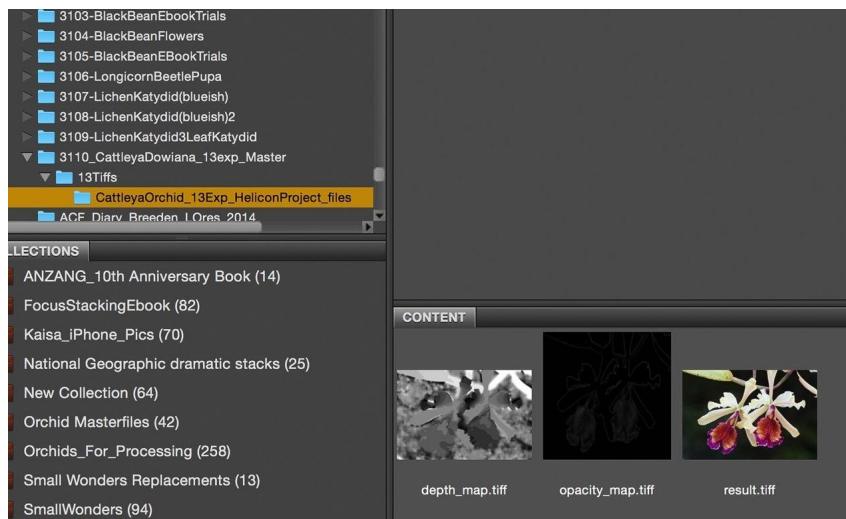




*C Pyramid result viewed at 100% (right hand window). Note contrast change.*



*Helicon: As with Zerene, you can select any file (even a DMap or whichever method's result you choose) to retouch with.*



*The saved Helicon project, viewed in Adobe Bridge. All method files and your final “result” file are saved.*



*Helicon: The finished 13-exposure stack, viewed in Photoshop.*

### **Open Masterfile in Photoshop for final edits**

Now it is time to open your Masterfile in Photoshop for regular image editing, de-spotting and background repair if necessary. See chapter on “Editing Backgrounds”.



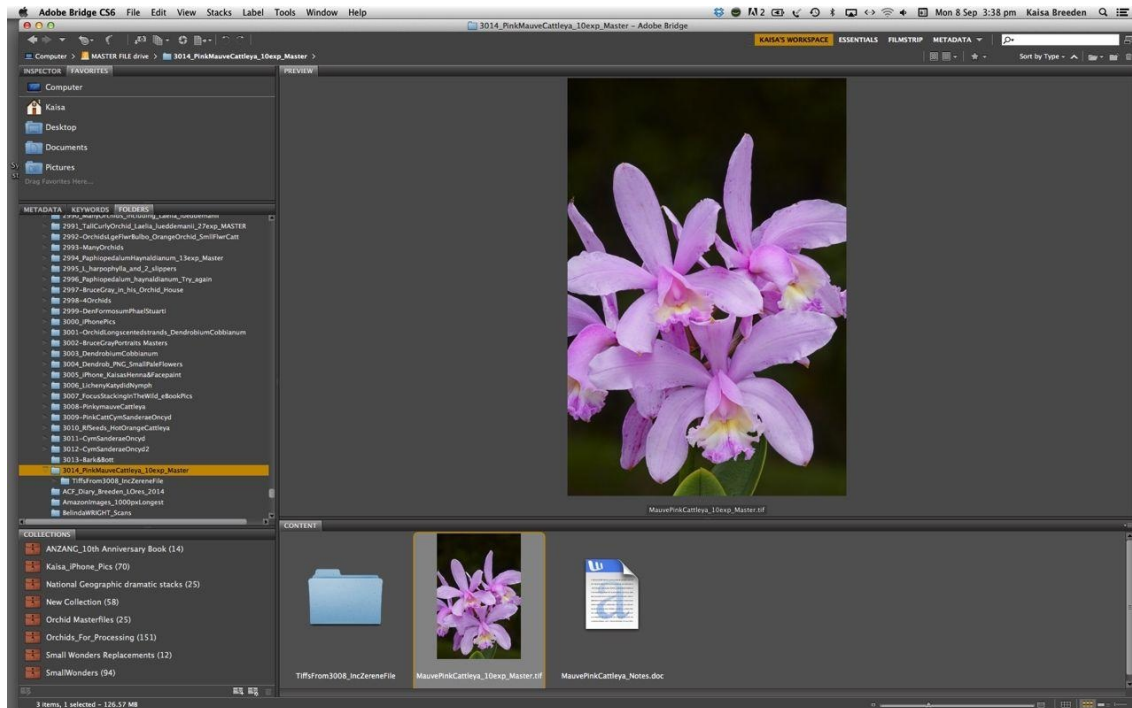


## EDITING BACKGROUNDS

### Taking your finished stack into Photoshop to finesse the background

This process ensures your backgrounds are soft, noise-free and rids your photograph of any remaining artifacts left from the stacking process.

If you paid attention to your backgrounds when you photographed your subject, you will find this process much easier.



*The stacked Masterfile, Zerene project folder and my notes as viewed in Adobe Bridge.*

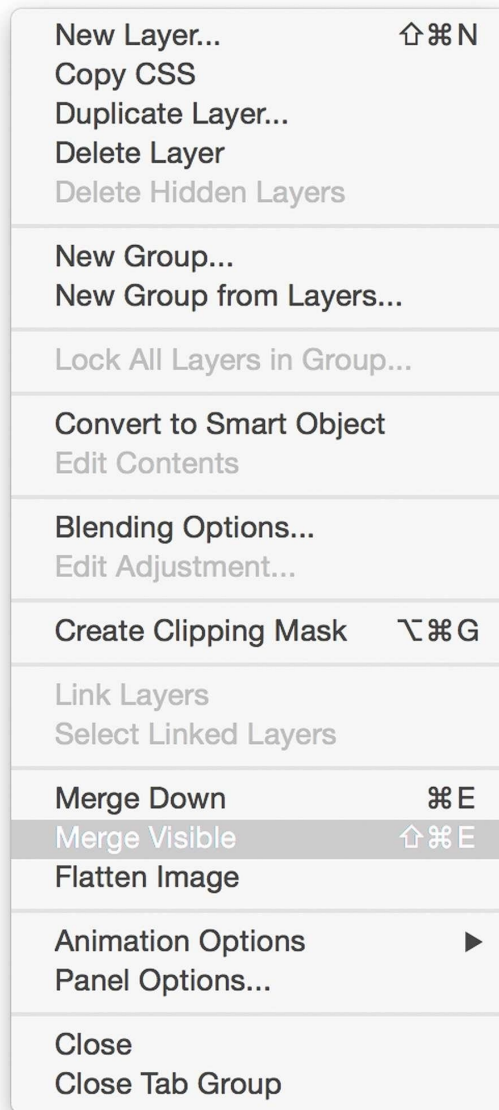
### OPEN YOUR MASTERFILE IN PHOTOSHOP.

I create my black point first. Always. It's a good habit to get into, and avoids colour difficulties later on.

I use a levels Adjustment layer to create my black point. I used to use curves. I even used to do it by numbers. Now I just use the histogram and individual channels and my EYES as my guide. You can add contrast & stuff later.

Create a new layer on top of the Levels layer. Select the layer. Holding down the Option key, click "Merge Visible" in the layer menu.





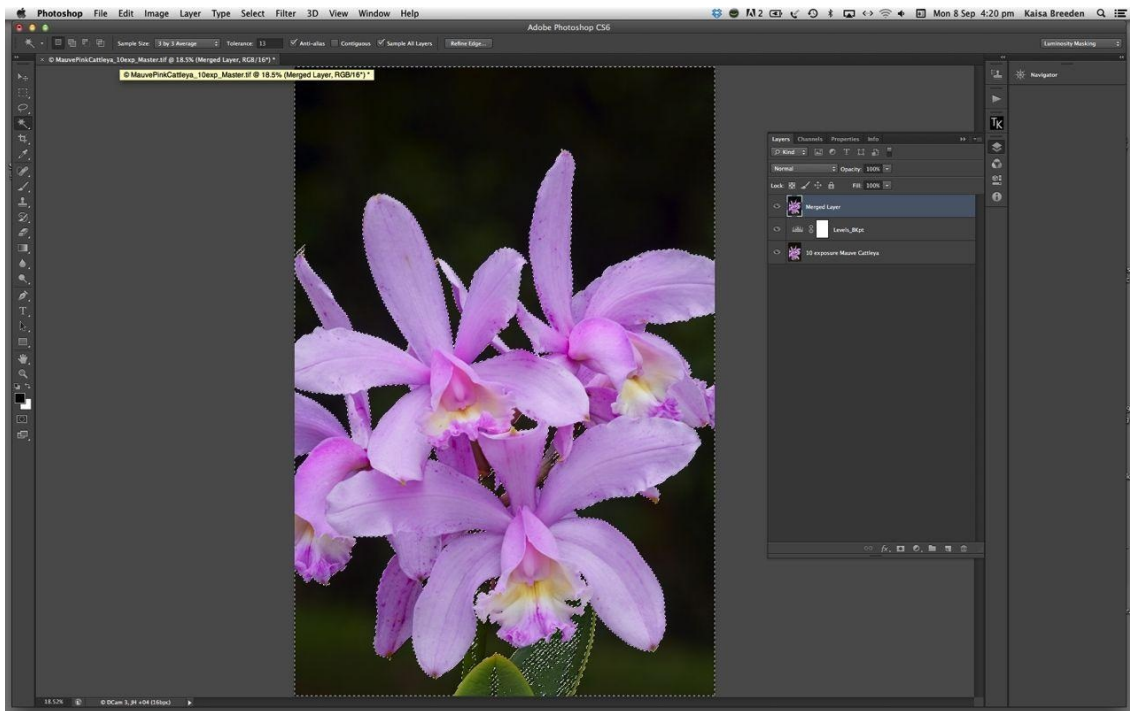
*Option-click “Merge Visible” in the Layers pull-down menu.*

THIS CREATES a new layer with all merged in it. Double-click the layer name to rename it. Call it something sensible, like “Merged”.

Now you are going to select your background. This is an easier task if you paid attention to your backgrounds in the photography stage.

To select the background: I use the magic wand tool, with a tolerance setting of 20-30. Click to select a mass of background colour, then Shift-click with the magic wand to add to that selection.

When you have selected all the background you can, zoom in to 100% (Command/Control 1) to ensure you’ve selected all the nooks and crannies around your subject (hold down the space bar to temporarily invoke the Hand tool), and fine-tune if needed by selecting or de-selecting more. If there’s any areas that you don’t want included and are having trouble excluding them, don’t fret—you can mask them out later.



*New merged layer and background selected with the magic wand tool in Photoshop. You can see the “marching ants” around the perimeter of the photograph and the edges of the orchid, indicating the selected area.*

SAVE this selection now as a channel (Select > Save Selection, and give it a name like “Background”). This crisp selection may well come in handy as a mask for later adjustments such as applying sharpening to your subject (but not your background).

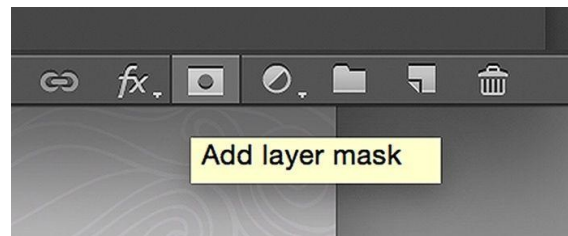
Copy and Paste the selected background. Mac shortcut: **Cmd+Shift+J**, Windows shortcut: **Ctrl+Shift+J**

Call this new layer “Pasted Background”, or “BG Blur” or similar:



*The pasted background layer, highlighted in blue in the Layers palette.*

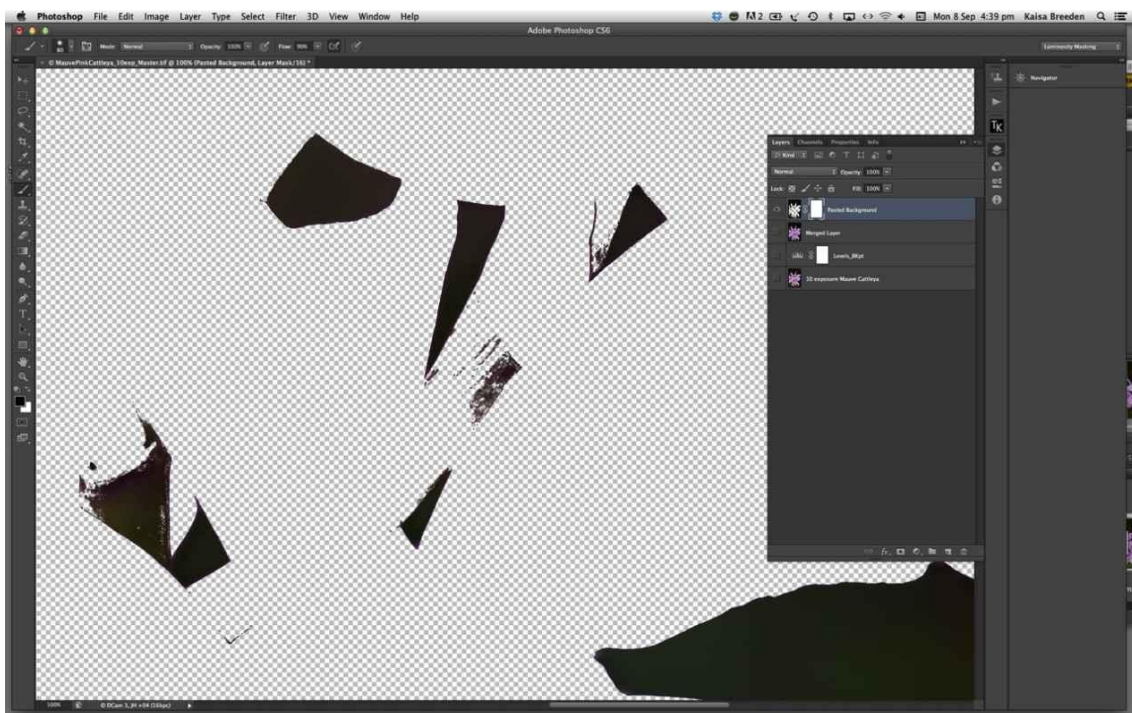
Add a Layer Mask to your “BG Blur” layer by clicking the icon in bottom of Layers Palette:



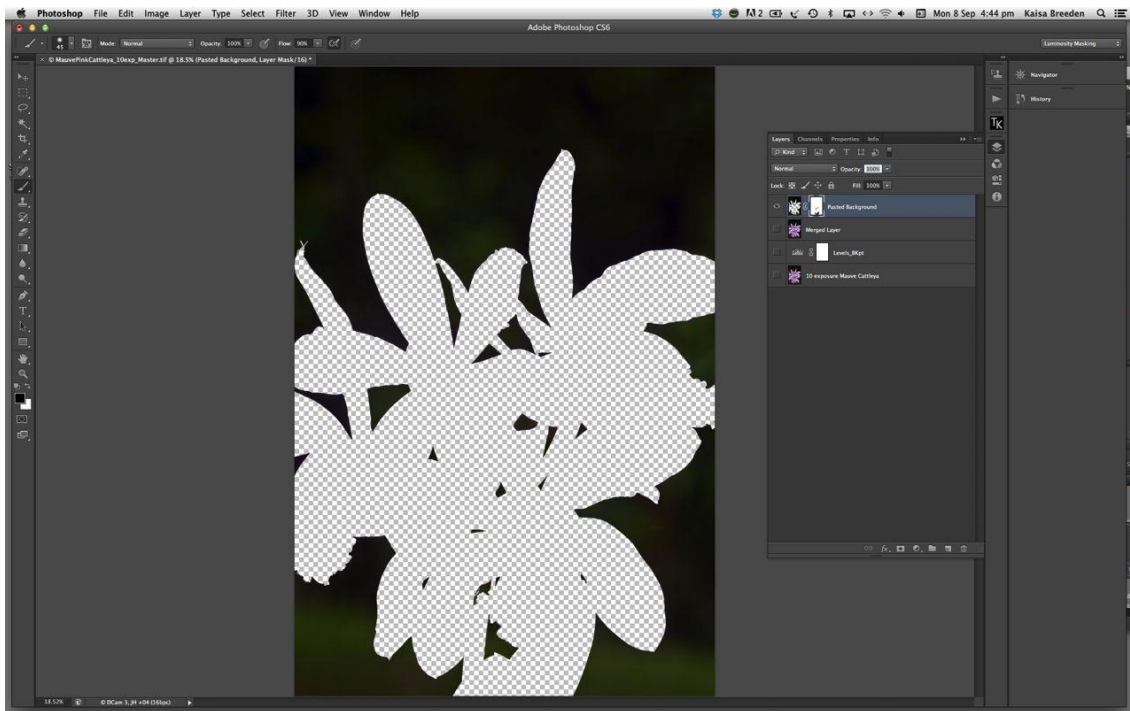
*The “Add Layer Mask” icon in Photoshop.*

ACTIVATE the mask by clicking on it, get a black brush at 100% opacity (Select the brush (B) tool, hold down CTRL+Alt/Opt on the keyboard click and hold while dragging left or right to adjust size).

Using your black brush, mask out anything that you don’t want included in the blur layer—that is, any artifacts or areas that were picked up that you don’t want blurred. You might not even have any.



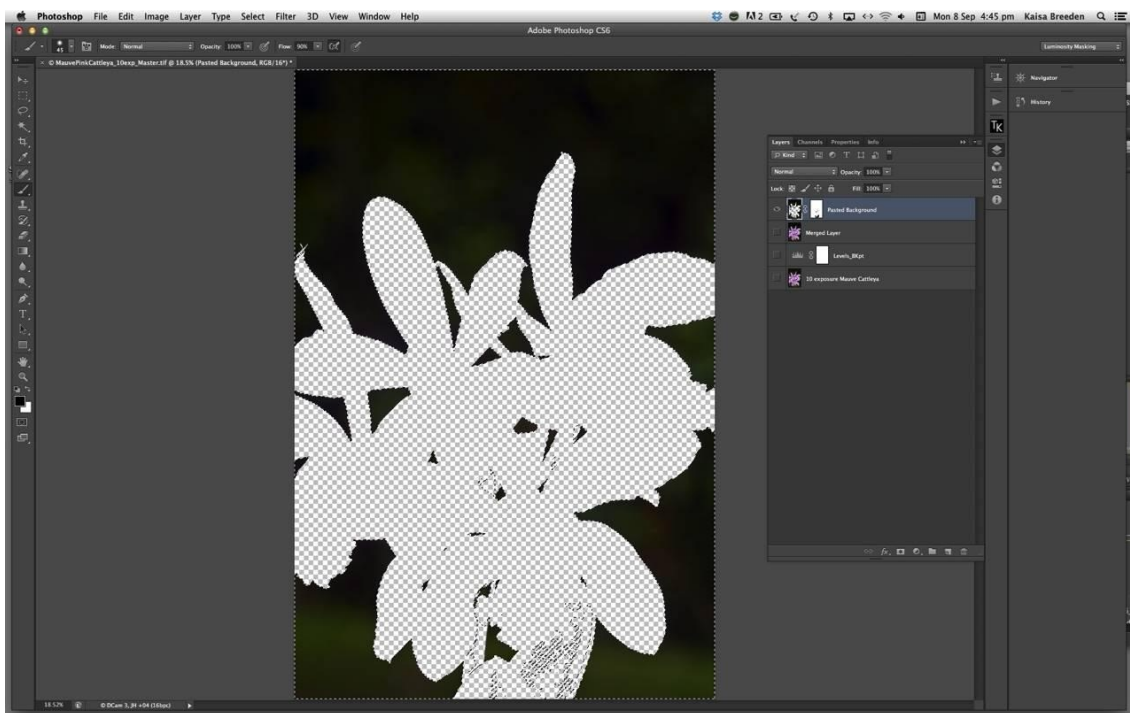
*Masking out areas to be excluded from further adjustments with a black brush.*



*The cleaned up Background layer and its mask.*

Optional: You can toss your “Merged” layer now.

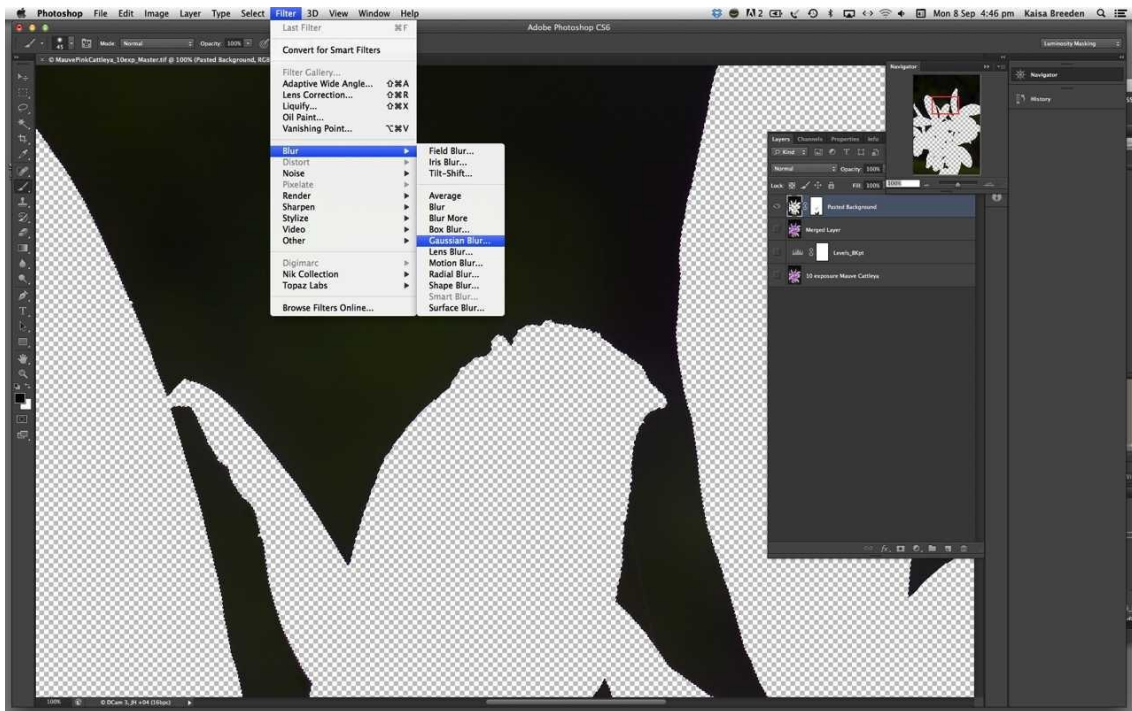
Load “BG Blur” layer by Command-clicking (Ctrl in Windows) its thumbnail (not the mask thumbnail) in the Layers palette:



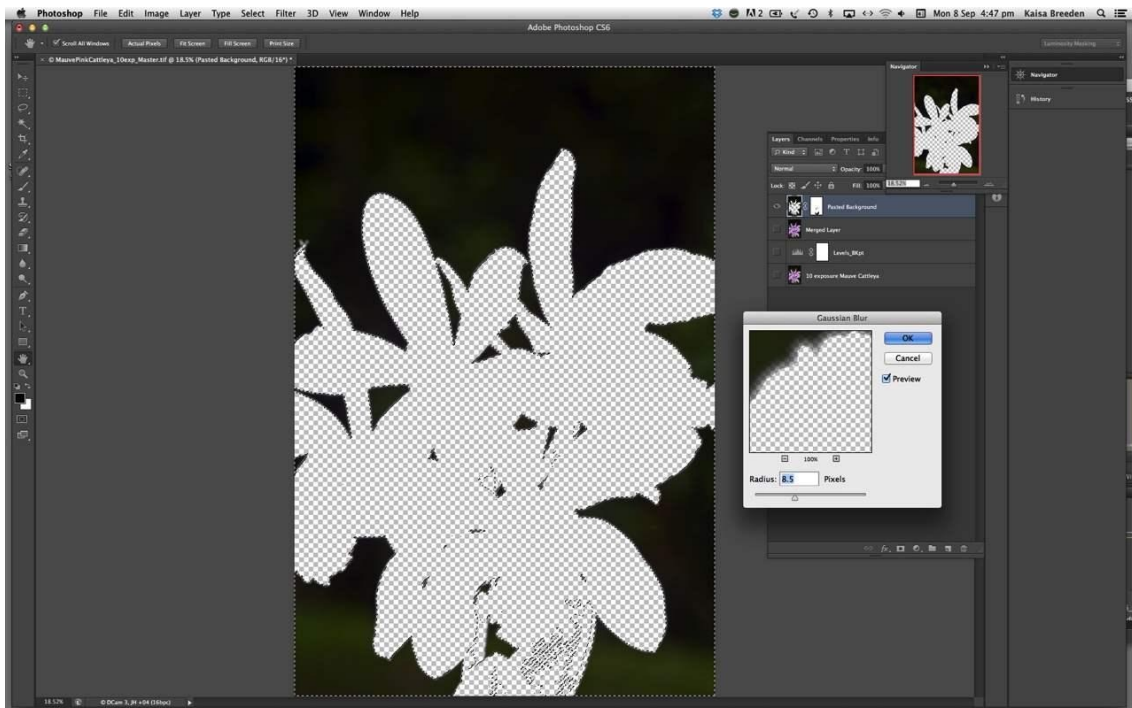
*Loading the Background Blur layer as a selection.*

Select Filter>Blur>Gaussian Blur. I usually use an amount anywhere from 15 to 25. There is no magic number; you use your own eyes and judge how much blur is enough for a nice soft effect that’s not too extreme or unnatural. Zoom out to fit the image to the screen to check too: Command/Control + 0 (that’s a zero).





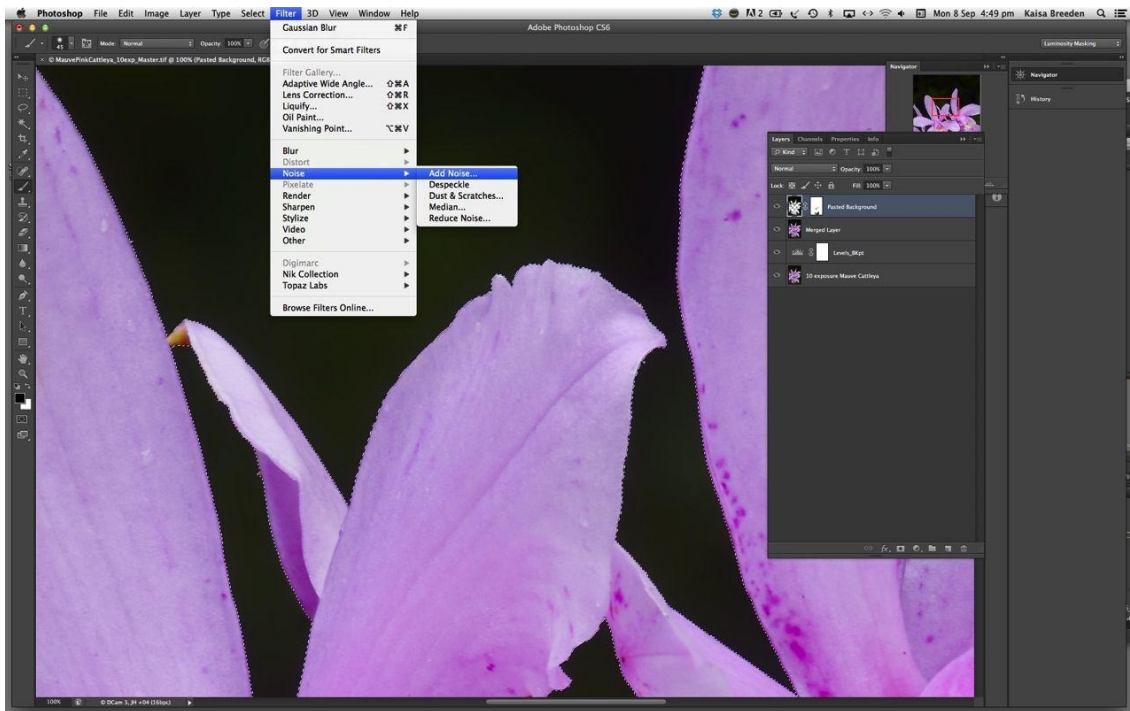
*Selecting Filter > Blur > Gaussian Blur*



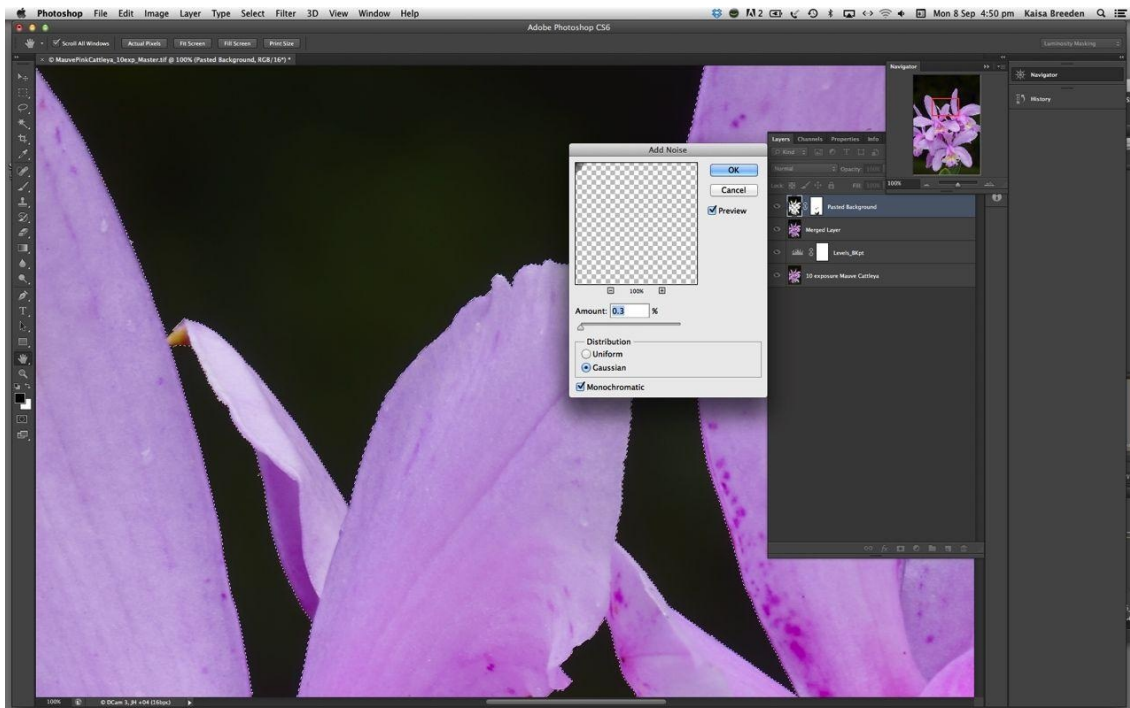
*Gaussian Blur settings*

Select Filter>Noise>Add Noise. Choose the lowest setting, Gaussian, Monochromatic. Repeat Add Noise 3 or more times. This is to avoid banding appearing in your blurred background.





*Select Filter > Noise > Add Noise*



*Noise settings: Use the lowest amount of noise.*

Now create a New Layer (**Command** (Mac) / **Control** (Win) + **Shift** + **N**) and call it “Retouch BG & De-spot”.

Zoom in to 100% and systematically scan your image for ghosting or blurry bits (especially in nooks and crannies around your subject). If you find an area needing repair, select it with the Lasso tool and then use the Eyedropper tool to sample the colour and paint it in with a brush. You may need a medium opacity.

If it’s a huge area you’re repairing, you may need to add noise to the painted area to avoid banding. Then deselect that area and continue to scan your image, left to right, top to bottom, till you know there aren’t any imperfect areas left.

Save your layered Masterfile.

Now you can finalise your regular edits, like contrast for instance. Your stacking work is complete!



*Completed 10-exposure masterfile.*







## OTHER TECHNIQUES AND HARDWARE

### A QUICK MENTION OF OTHER TECHNIQUES

#### Macro Rails

Instead of changing focus through the lens the way we do, with macro rails the camera is *physically* moved fore and aft, towards or away from your subject. Focus remains set. These can be manual or motorized rails:

##### —Manual

For manual control, you need macro rails. The best we've seen are made by [Really Right Stuff](#):



*Really Right Stuff's macro focusing rail.*

—**Motorized:** [Stackshot by Cognisys](#). It can be controlled manually or automatically, allows for multiple exposures at each step (eg. for mirror lockup), can be battery powered for working out in the field. The increments/steps can be very fine and accurate.



*Stackshot Macro Rail package by Cognisys.*

—**Software controlled focus stacking:**

Stackshot can also be controlled connected via USB to a computer and using a driver for [Zerene Stacker](#) or [Helicon Remote](#).

There is other software that can stack by controlling the focussing mechanisms within auto-focus lenses (no rail needed) when shooting tethered to your computer, such as [Helicon Remote](#) (Canon and Nikon compatible) and [Canon EOS Utility](#).





## CONCLUSION AND GALLERY

We hope you find Focus Stacking in the Wild an inspiring spring-board into a new realm of macro photography.

We'd love to see what you get up to, so don't hesitate to shoot us an e-mail, and tag your work #FocusStackingInTheWild on Instagram.

We have other e-books in mind, particularly on the topics of Photoshop editing for Natural Light Photography and iPhoneography. If there's anything you'd like to see or suggest, please [get in touch](#).

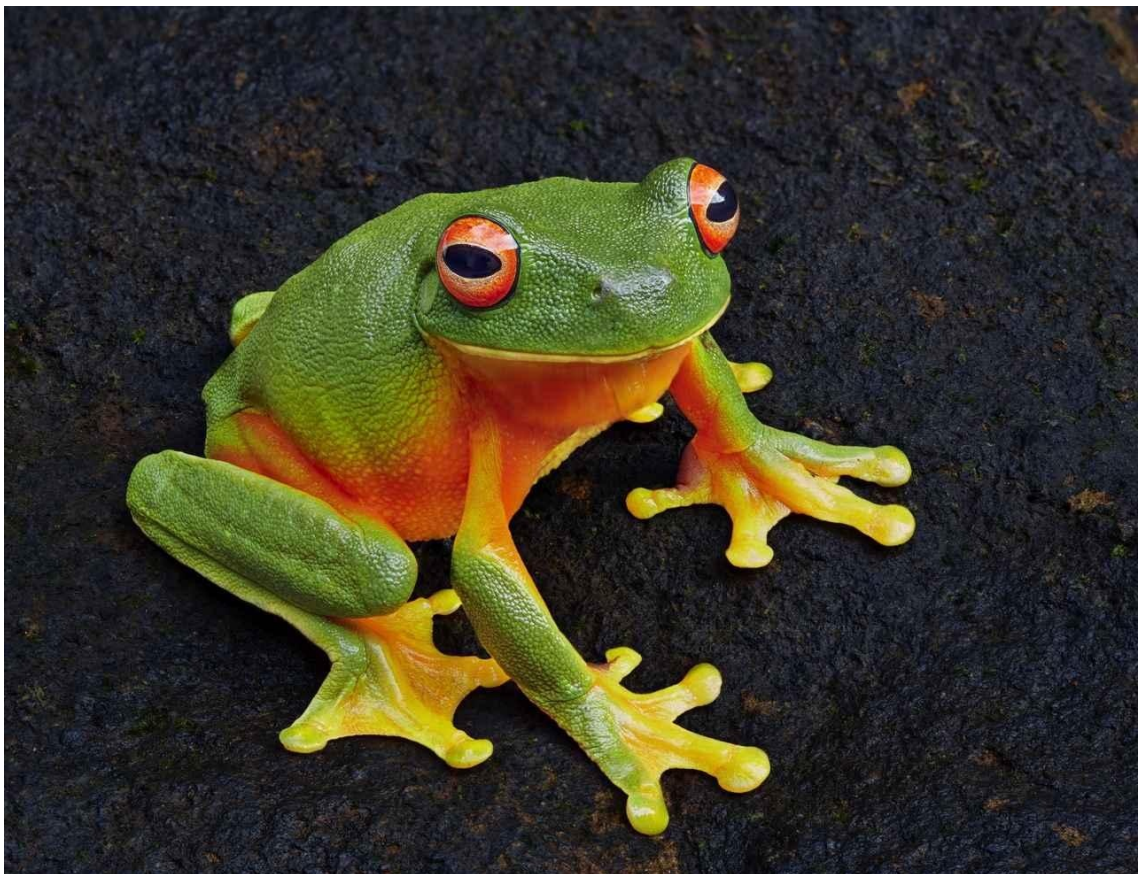


*Chafer beetle. A 14-exposure focus stack.*





*Golden Mantis. She is a 19-exposure focus stack.*



*Orange-eyed Tree Frog. A 14-exposure focus stack.*



*Orchard Butterfly. A 6-exposure focus stack.*





*Native Passionfruit. A 10-exposure stack.*



*Porcupine Wattle. A 5-exposure focus stack.*





## ACKNOWLEDGMENTS

Many thanks to all the folks who kindly sponsored us, gave advice, help and permission to use images and information about their products:

[Joseph Holmes](#) for his immense knowledge and generosity, and his gorgeous [DCam profiles](#) that revolutionised my handling and knowledge of colour.

Rik Littlefield of [Zerene Systems](#), creator of stacking software, [ZereneStacker](#):



[Helicon Focus](#) by [HeliconSoft](#)—focus stacking software:



Paul DeZeeuw of [Cognisys Inc.](#) for [StackShot](#):



[Really Right Stuff](#)—camera plates, macro slides, tripods. All exquisitely engineered:

[Phase One](#)—creators of our favourite RAW development software, [Capture One Pro](#):



PHASE ONE

Iridient Developer by [Iridient Digital](#)—RAW development software:



L&P Digital Photographic:





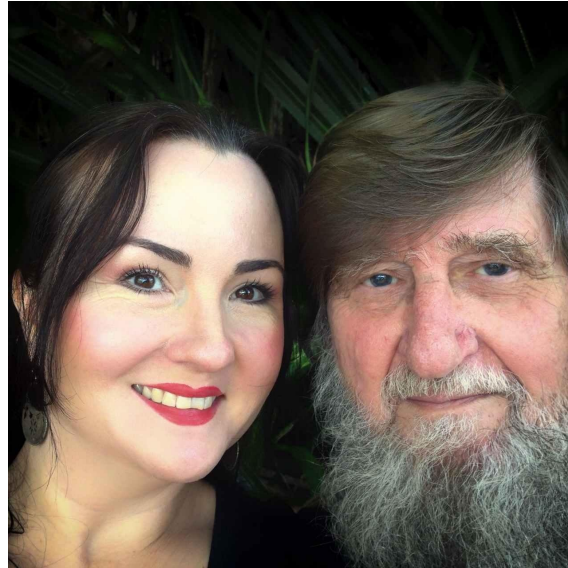
## ABOUT THE AUTHORS

### Kaisa and Stan

Like Tweedle-dum and Tweedle-dee, Kaisa and Stan have a symbiotic working relationship wherein neither can do what they do without the other. Stan's field of expertise is cameras, film and photography, and Kaisa's is colour and software and experimenting with what digital sensors can pull off. The "I" voice in this book is Kaisa's.

They are award-winning nature photographers and writers, specialising in macro focus-stacking in the wild.

[www.stanleybreeden.com](http://www.stanleybreeden.com)



*Kaisa and Stan (the one with the beard)*

### Bios

#### Stanley Breeden

Born in the Netherlands, Stan emigrated to Australia in his early teens.

Today, Stan is recognised as one of Australia's pioneering nature photographers and writers.

He is the author of some 20 natural history books, and has been published in the world's leading natural history magazines.

He is a double **Emmy-award** winning documentary film-maker and writer, having worked in both Australia and India for **National Geographic**.

After retiring from film photography, he embraced the digital realm with gusto.

Together with Kaisa, Stan produces fantastically clear and detailed views of nature's realms, using their pioneering new techniques of focus stacking *combined with* HDR and macro panorama photography.

#### Kaisa Breeden

Kaisa hails from the bush of the Blue Mountains near Sydney, where she grew up in a family of artists, designers, writers and marionette puppeteers.

She is a third generation artist/designer in her family (on both sides), received a Diploma of Multimedia in 2002, and has devoted the last thirteen years to exploring high-end digital photography techniques.

Kaisa pioneered new digital photographic methods of focus stacking combined with HDR and macro panorama photography.

As a result, many of the subjects she and Stan depict are composed of five, and up to 25 or more photographs. This goes some way to explaining their never-before-seen detail and luminosity. Her ultimate aim is to produce photographs so detailed and clear, you feel you could reach into them.

Kaisa was featured as one of the **Top Ten iPhoneographers** by Misho Baranovic on Digital Photography School ([digital-photography-school.com](http://digital-photography-school.com)), and on ABC Arts ([abc.net.au](http://abc.net.au)).

Some recent interviews about Stan & Kaisa and their work:

- [Radio National Interview: Books and Arts Daily: Small Wonders—a new way of seeing nature](#)
- [Go No Go: Podcast: Small Wonders—Interview with Stanley and Kaisa Breeden](#)

*For more information about Stan and Kaisa Breeden's work:*

- [@StanleyBreedon](#)
- [KaisaStanleyBreedon](#)

[www.stanleybreeden.com](http://www.stanleybreeden.com)

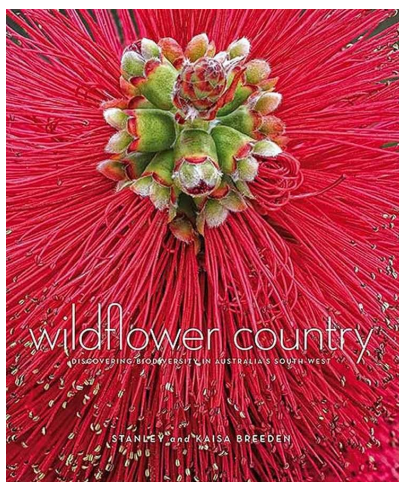
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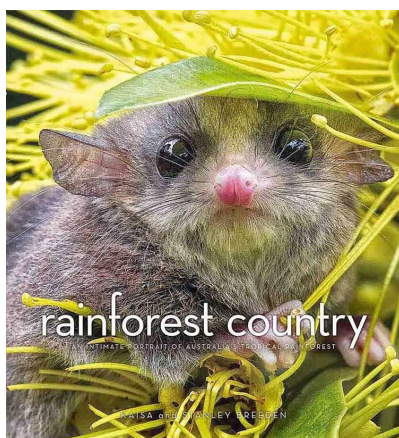


## ALSO BY KAISA AND STANLEY BREEDEN

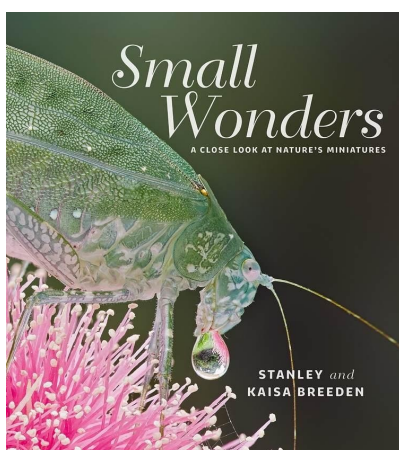
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*Rainforest Country*



*Small Wonders*

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